<110> CASTADO, Cindy
DENOEL, Philippe
GODFROID, Fabrice
POOLMAN, Jan

<120> PERTUSSIS ANTIGENS AND USE THEREOF IN VACCINATION

<130> VB60452

<140> Not Yet Assigned
<141> 2006-03-31

<150> PCT/EP2004/011082
<151> 2004-10-01

<150> GB 0323113.1
<151> 2003-10-02

<150> GB 0323112.3
<151> 2003-10-02

<160> 110

<170> FastSEQ for Windows Version 4.0

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<211> 2214
<212> DNA
<213> Bordetella Pertussis

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gcgacggtgc aggtgctggg cacggccgaa gaggaaatca aggagtcgct gggcgtctcg 180
gtcatcaccg ccgaggagat cgcccgccgc ccgcccacca atgacctgtc cgacctgatc 240
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cccgtcacct cgcgcaatgc ggtgcgctat ggctggaacg gcgaccggga cacgcgcggg 420
gacaccaact gggtgcccgc cgaggaagtc gagcgcatcg aagtgatccg cggcccggcc 480
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gccgatcgcg ccaccggctc catcacctac tacacgaacc agccggaaga cagccgcgag 600
ggcaacacca accgcgtcaa tgcgcgcatc agcgcgccga tcagcgacac gctgagcatg 660
cggctgtacg gcaactacaa caagaccaat ccggatgccc gcgacatcaa cgccggccac 720
gcgaacacca gcgacaacgg caacccctcg accgccggac gcgagggcgt catcaaccag 780
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gaccccgccg gcacgcgcca gacctatacc ggcggcgcca tcggcggcac ggccccggcc 1260
gaccgcgacc cgaaatcgcg ccagaccagc tatgcgctgt tcgccgagga caacatcgag 1320
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agcaactgga gtcccagcct gaacgcctcg tacgccgtca ccgacgcgct caagctcaag 1440
ggtggcatcg cgcgcgccta caaggcgccc aacctctacc aatccaaccc caactacctg 1500
ctgtacagcc gcggcaatgg ctgcctggcc tcgcagacca acaccaacgg ctgctatctg 1560

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gtcggcaacg aggacctctc gccggaaacc agcgtcaaca aggaaatcgg cttcgagtac 1620
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aatctcgact ggaacaccaa cttcacctac atgatccagt ccaaggaaaa ggctaccggc 1860
gaacccttga gcgtgattcc cgaatacacc atcaacagca cgctggactg gttctacacg 1920
ccgcagctgt cgttccaggc caatctcacc tattacggca agcaggaagg cccgtccacc 1980
aatgtacgca ccggcgtcga actgaacggc gacggccgcc agaccatcag tccgtatgcc 2040
ctggcgggcc tgagcatggg ctacgaagtc aaccggaacc tgaagttccg cgtcggcgtg 2100
agcaacctgt tcgacaagca gctgtaccgc gaaggcaatg ccagcagcgc gggcgcggcc 2160
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<210> 2
<211> 737
<212> PRT
<213> Bordetella Pertussis

<400> 2

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            20                  25                  30
Asp Pro Ser Gln Val Gln Gln Met Ala Thr Val Gln Val Leu Gly Thr
        35                  40                  45
Ala Glu Glu Glu Ile Lys Glu Ser Leu Gly Val Ser Val Ile Thr Ala
    50                  55                  60
Glu Glu Ile Ala Arg Arg Pro Pro Thr Asn Asp Leu Ser Asp Leu Ile
65                  70                  75                  80
Arg Arg Glu Pro Gly Val Asn Leu Thr Gly Asn Ser Ala Ser Gly Ala
                85                  90                  95
Arg Gly Asn Ser Arg Gln Val Asp Ile Arg Gly Met Gly Pro Glu Asn
            100                 105                 110
Thr Leu Ile Leu Ile Asp Gly Lys Pro Val Thr Ser Arg Asn Ala Val
        115                 120                 125
Arg Tyr Gly Trp Asn Gly Asp Arg Asp Thr Arg Gly Asp Thr Asn Trp
    130                 135                 140
Val Pro Ala Glu Glu Val Glu Arg Ile Glu Val Ile Arg Gly Pro Ala
145                 150                 155                 160
Ala Ala Arg Tyr Gly Ser Gly Ala Met Gly Gly Val Val Asn Ile Ile
                165                 170                 175
Thr Lys Arg Pro Ala Asp Arg Ala Thr Gly Ser Ile Thr Tyr Tyr Thr
            180                 185                 190
Asn Gln Pro Glu Asp Ser Arg Glu Gly Asn Thr Asn Arg Val Asn Ala
        195                 200                 205
Arg Ile Ser Ala Pro Ile Ser Asp Thr Leu Ser Met Arg Leu Tyr Gly
    210                 215                 220
Asn Tyr Asn Lys Thr Asn Pro Asp Ala Arg Asp Ile Asn Ala Gly His
225                 230                 235                 240
Ala Asn Thr Ser Asp Asn Gly Asn Pro Ser Thr Ala Gly Arg Glu Gly
                245                 250                 255
Val Ile Asn Gln Asp Leu Ser Ala Leu Phe Ser Trp Lys Ala Asp Ser
            260                 265                 270
His Asn Thr Val Asp Leu Asp Met Gly Phe Ser Arg Gln Gly Asn Leu
        275                 280                 285
Phe Ala Gly Asp Thr Met Asn Asn Ala Asn Ser Asp Phe Ser Asp Ser
    290                 295                 300
Leu Tyr Gly Lys Glu Thr Asn Ala Met Tyr Arg Glu Asn Tyr Ala Leu
305                 310                 315                 320
Thr His Arg Gly Val Tyr Asp Trp Gly Thr Ser Arg Ala Ser Val Gly
                325                 330                 335
Tyr Asp Tyr Thr Arg Asn Ala Arg Gln Arg Glu Gly Leu Ala Gly Gly
```

```
            340                 345                 350
Pro Glu Gly Ala Pro Thr Ala Gly Gly Tyr Asp Thr Ala Arg Leu Lys
        355                 360                 365
Asn Trp Arg Ala Ala Ala Glu Ala Ser Val Pro Phe His Leu Gly Phe
    370                 375                 380
Glu Gln Val Ala Thr Val Gly Val Glu Trp Leu Arg Glu Ser Leu Glu
385                 390                 395                 400
Asp Pro Ala Gly Thr Arg Gln Thr Tyr Thr Gly Gly Ala Ile Gly Gly
                405                 410                 415
Thr Ala Pro Ala Asp Arg Asp Pro Lys Ser Arg Gln Thr Ser Tyr Ala
            420                 425                 430
Leu Phe Ala Glu Asp Asn Ile Glu Ile Asp Glu Arg Thr Met Leu Thr
        435                 440                 445
Pro Gly Val Arg Leu Asp His Asn Ser Glu Phe Gly Ser Asn Trp Ser
    450                 455                 460
Pro Ser Leu Asn Ala Ser Tyr Ala Val Thr Asp Ala Leu Lys Leu Lys
465                 470                 475                 480
Gly Gly Ile Ala Arg Ala Tyr Lys Ala Pro Asn Leu Tyr Gln Ser Asn
                485                 490                 495
Pro Asn Tyr Leu Leu Tyr Ser Arg Gly Asn Gly Cys Leu Ala Ser Gln
            500                 505                 510
Thr Asn Thr Asn Gly Cys Tyr Leu Val Gly Asn Glu Asp Leu Ser Pro
        515                 520                 525
Glu Thr Ser Val Asn Lys Glu Ile Gly Phe Glu Tyr Asp Pro Gly Thr
    530                 535                 540
Trp Arg Thr Ser Met Ala Tyr Phe Arg Asn Asp Tyr Arg Asn Lys Ile
545                 550                 555                 560
Val Ala Gly Thr Asp Val Gln Tyr Arg Leu Ala Asn Gly Ala Arg Val
                565                 570                 575
Leu Gln Trp Thr Asn Ser Gly Lys Ala Val Val Glu Gly Leu Glu Gly
            580                 585                 590
Asn Leu Phe Ile Pro Leu Ala Ser Asn Leu Asp Trp Asn Thr Asn Phe
        595                 600                 605
Thr Tyr Met Ile Gln Ser Lys Glu Lys Ala Thr Gly Glu Pro Leu Ser
    610                 615                 620
Val Ile Pro Glu Tyr Thr Ile Asn Ser Thr Leu Asp Trp Phe Tyr Thr
625                 630                 635                 640
Pro Gln Leu Ser Phe Gln Ala Asn Leu Thr Tyr Tyr Gly Lys Gln Glu
                645                 650                 655
Gly Pro Ser Thr Asn Val Arg Thr Gly Val Glu Leu Asn Gly Asp Gly
            660                 665                 670
Arg Gln Thr Ile Ser Pro Tyr Ala Leu Ala Gly Leu Ser Met Gly Tyr
        675                 680                 685
Glu Val Asn Arg Asn Leu Lys Phe Arg Val Gly Val Ser Asn Leu Phe
    690                 695                 700
Asp Lys Gln Leu Tyr Arg Glu Gly Asn Ala Ser Ser Ala Gly Ala Ala
705                 710                 715                 720
Thr Tyr Asn Glu Pro Gly Arg Ala Tyr Tyr Ala Thr Ala Thr Val Ser
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Phe
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<210> 3
<211> 2478
<212> DNA
<213> Bordetella Pertussis

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gccttgtgcg ccgtcgcggt cggtagcgcg gacaccgccc gcgcgcaggc gcccgccgcc 120

```
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ggcctgcagg gcgtgtacgg cgtgcgcgac gggttcgcgg cgctgctggc cggctcgggc 300
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gatgcgcaga cgctggcgcc ggtgacggtg ctgggcctgg agggcgcgct ggcgcccacg 420
gtcggctatg tcgccagtgc cagcctgagc ggcaccaaga ccgatacgcc gctgatcgaa 480
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acgcggctgg accagttcag cgtgcgcggt ttctccgccg ccacctatct ggacggcatg 660
cgcgtgttcg gcggccggga cgccttgccc caggtcgacg cctaccggct cgaacgggtc 720
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<210> 4
<211> 825
<212> PRT
<213> Bordetella Pertussis

<400> 4

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Val Leu Ala Ala Ala Leu Cys Ala Val Ala Val Gly Ser Ala Asp Thr
            20                  25                  30
Ala Arg Ala Gln Ala Pro Ala Ala Ser Ala Gln His Tyr Glu Ile Ala
        35                  40                  45
Ala Gly Pro Leu Ala Asp Ala Leu Thr Arg Phe Ala Arg Arg Ala Gly
    50                  55                  60
Val Val Leu Ser Phe Asp Pro Ala Leu Val Gln Gly Arg Ser Thr Ala
65                  70                  75                  80
Gly Leu Gln Gly Val Tyr Gly Val Arg Asp Gly Phe Ala Ala Leu Leu
                85                  90                  95
Ala Gly Ser Gly Leu Gln Ala Arg Ala Gly Gly Gly Asn Asn Trp Ser
            100                 105                 110
```

```
Leu Ala Ala Leu Pro Arg Gly Gly Asp Ala Gln Thr Leu Ala Pro Val
        115                 120                 125
Thr Val Leu Gly Leu Glu Gly Ala Leu Ala Pro Thr Val Gly Tyr Val
    130                 135                 140
Ala Ser Ala Ser Leu Ser Gly Thr Lys Thr Asp Thr Pro Leu Ile Glu
145                 150                 155                 160
Thr Pro Gln Ser Ile Ser Val Val Thr Arg Asp Gln Ile Thr Glu Gln
                165                 170                 175
Gly Ala Gln Thr Leu Asn Gln Val Leu Arg Tyr Thr Ala Gly Val Ala
            180                 185                 190
Thr Glu Thr Arg Gly Ala Thr Ala Thr Arg Leu Asp Gln Phe Ser Val
        195                 200                 205
Arg Gly Phe Ser Ala Ala Thr Tyr Leu Asp Gly Met Arg Val Phe Gly
    210                 215                 220
Gly Arg Asp Ala Leu Pro Gln Val Asp Ala Tyr Arg Leu Glu Arg Val
225                 230                 235                 240
Asp Val Leu Lys Gly Pro Ala Ser Val Leu Tyr Gly Gln Gly Gly Pro
                245                 250                 255
Gly Gly Val Val Asn Gln Val Ser Lys Arg Pro Leu Asp Glu Pro Leu
            260                 265                 270
Arg Glu Ile Glu Val Gln Ala Gly Asn Phe Asp Phe Arg Arg Val Asn
        275                 280                 285
Met Asp Phe Ser Gly Pro Val Asp Glu Asp Arg Arg Phe Leu Tyr Arg
    290                 295                 300
Val Thr Gly Ala Ala Tyr Met Ser Asp Gly Gln Val Asp His Thr Arg
305                 310                 315                 320
Glu Arg Arg Tyr Phe Val Ser Pro Ser Phe Thr Trp Arg Pro Ser Ala
                325                 330                 335
Asp Thr Thr Leu Thr Val Leu Thr Asn Phe Gln Arg Asp Pro Asp Met
            340                 345                 350
Gly Ser Tyr Gly Ser Ile Ser Ala Met Arg Thr Leu Leu Ser Ala Pro
        355                 360                 365
Asp Gly Arg Arg Leu Gly Pro Asn His Tyr Asp Gly Asp Ala Asp Phe
    370                 375                 380
Glu Lys Ser Asp Arg Arg Ser Tyr Ser Leu Gly Tyr Gln Leu Glu His
385                 390                 395                 400
Arg Phe Asn Asp Thr Phe Lys Ala Ser Gln Asn Leu Arg Phe Gln His
                405                 410                 415
Ala Glu Gly Val Tyr Arg Ser Ile Tyr Gly Ala Ser Asn Asn Asn Tyr
            420                 425                 430
Gly Tyr Leu Asp Lys Asp Tyr Arg Tyr Ser Gln Arg Gly Leu Ala Ile
        435                 440                 445

Ser Asp Val Asp Val Asp Ala Phe Thr Ile Asp Asn Asn Leu Gln Ala
    450                 455                 460
Arg Phe Asp Thr Gly Ala Leu Ala His Thr Val Leu Val Gly Phe Asp
465                 470                 475                 480
Tyr Gln Arg Val Gln Thr Asp Thr Leu Ser Gly Tyr Gly Ser Ala Pro
                485                 490                 495
Pro Leu Asp Val Phe Asp Pro Asp Tyr His Met Gly Ile Glu Arg Pro
            500                 505                 510
Pro Phe Thr Ser Asp Gln Thr Gln Tyr Asn Tyr Gln Thr Gly Leu Tyr
        515                 520                 525
Leu Gln Asp Gln Ile Arg Leu Asp Arg Leu Ser Leu Leu Leu Gly Gly
    530                 535                 540
Arg Tyr Asp Trp Ser Arg Thr His Thr Gly Thr Asp Asn Leu Ala Asn
545                 550                 555                 560
Gly Ser His Ser Ser Ser Ala Leu Ala Ala Glu Ala Phe Thr Gly Arg
                565                 570                 575
Val Gly Ala Ile Tyr Asn Phe Asp Asn Gly Val Ala Pro Tyr Ala Ser
            580                 585                 590
```

```
Tyr Ser Glu Ser Phe Glu Pro Gln Thr Gly Thr Gly Trp Asn Asn Thr
        595                 600                 605
Pro Phe Lys Pro Thr Glu Gly Lys Gln Tyr Glu Val Gly Val Lys Tyr
    610                 615                 620
Gln Pro Pro Gly Ser Ala Thr Leu Leu Thr Leu Ala Ala Phe Asp Ile
625                 630                 635                 640
Arg Arg Lys Asn Leu Pro Thr Thr Asp Pro Asp Pro Thr His Met Cys
                645                 650                 655
Gly Val Ser Arg Cys Ser Ile Gln Ala Gly Glu Val Arg Thr Arg Gly
            660                 665                 670
Ile Glu Leu Glu Ala Lys Thr Glu Pro Leu Arg Gly Leu Ser Leu Ile
        675                 680                 685
Ala Ala Tyr Ser Tyr Leu Asp Asn Glu Tyr Glu Lys Ala Tyr Pro Asn
    690                 695                 700
Thr Thr Gly Leu Asp Leu Lys Gly Lys Lys Pro Val Ala Val Pro Ala
705                 710                 715                 720
His Gln Ala Ser Ala Trp Ala Arg Tyr Gln Leu Gln Glu Gly Pro Leu
                725                 730                 735
Ala Gly Leu Gly Met Gly Ala Gly Val Arg Tyr Ile Gly Ser Ser Tyr
            740                 745                 750
Ala Asn Glu Thr Asn Thr Leu Lys Val Pro Ser Val Thr Leu Val Asp
        755                 760                 765
Met Met Leu Asp Tyr Asp Leu Gly Arg Ala Ser Pro Ala Leu Lys Gly
    770                 775                 780
Met Gln Val Ala Leu Asn Val Ser Asn Leu Phe Asp Lys Glu Tyr Ile

785                 790                 795                 800
Gly Ser Cys Leu Ser Asp Ser Trp Cys Trp Tyr Gly Tyr Gln Arg Ser
                805                 810                 815
Ile Lys Ala Ser Leu Arg Tyr Arg Trp
            820                 825
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<210> 5
<211> 2406
<212> DNA
<213> Bordetella Pertussis

<400> 5

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atcgacgtcg atatcccgcc ccagaacctg gcccaagccc tgcaccagct tggccggcaa 180
gccaacctgc aggtcctgta cagccaggac ctggtcgatg gccagcgcag ccccgccgtg 240
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tattcgatcc agcacaacac cgtcacgctc acgcccatgc cgctgactgc gacgctgccg 360
gcaatcagcg tggtcggcgc cctgcctgac tccgacacct acgtggccac aggcacgaca 420
gccggcacca agacggacac gccgctgatc gaaataccgc aatccatttc ggtggtgacc 480
gccgcgcaga tccgcgagca gaatccgcag acgctgggcg acgccgtgcg ctacacgccc 540
ggtatcgtgg tgcaggaagg attcaaccgc accgacgatc ctttcatcat ccgcggcttc 600
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acagacagcc cgctgcgcga gctgcagctg agcggcggct cgcacagcaa caggcagctc 840
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ctggcgcgca atgccgacac gatgatcgac catgtcccgg acgaccgcta ctatctcgcc 960
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cagaacctgg gctacgccca gtcgcgcaac cgcgtcaacc acgcctactg gtggacctgg 1260
gtgcccggaa gcgacttctc cacggccgag cgcggcgcct accgccgcga cgatgacgcc 1320
```

```
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aacacgctgt tcggcctcga ttacaccgaa acctcgttca cccgcaaaca gtacgccggc 1440
tacaacaacc tcgccccgat cgacttcttc gatccggcgt acggctcgga cgtactgctg 1500
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tggtag                                                            2406
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<210> 6
<211> 801
<212> PRT
<213> Bordetella Pertussis

<400> 6

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Arg Pro Arg Arg Leu Ile Pro Ala Leu Leu Gly Ala Leu Ala Cys Leu
            20                  25                  30
Gly Thr Gly Val Gln Ala Ala Pro Ile Asp Val Asp Ile Pro Pro Gln
        35                  40                  45
Asn Leu Ala Gln Ala Leu His Gln Leu Gly Arg Gln Ala Asn Leu Gln
    50                  55                  60
Val Leu Tyr Ser Gln Asp Leu Val Asp Gly Gln Arg Ser Pro Ala Val
65                  70                  75                  80
Gln Gly Arg Met Glu Pro Ala Glu Ala Leu Glu Arg Leu Leu Lys Gly
                85                  90                  95
Arg Asn Ile Arg Tyr Ser Ile Gln His Asn Thr Val Thr Leu Thr Pro
            100                 105                 110
Met Pro Leu Thr Ala Thr Leu Pro Ala Ile Ser Val Val Gly Ala Leu
        115                 120                 125
Pro Asp Ser Asp Thr Tyr Val Ala Thr Gly Thr Thr Ala Gly Thr Lys
    130                 135                 140
Thr Asp Thr Pro Leu Ile Glu Ile Pro Gln Ser Ile Ser Val Val Thr
145                 150                 155                 160
Ala Ala Gln Ile Arg Glu Gln Asn Pro Gln Thr Leu Gly Asp Ala Val
                165                 170                 175
Arg Tyr Thr Pro Gly Ile Val Val Gln Glu Gly Phe Asn Arg Thr Asp
            180                 185                 190
Asp Pro Phe Ile Ile Arg Gly Phe Asp Val Arg Thr Asn Pro Gly Val
        195                 200                 205
Met Phe Arg Asp Gly Leu Lys Ile Pro Leu Pro His Tyr Ser Ala Met
    210                 215                 220
Ser Glu Pro Tyr Ala Leu Glu Arg Ile Glu Val Val Lys Gly Pro Ala
225                 230                 235                 240
Ser Val Leu Tyr Gly Gln Ala Ser Pro Gly Gly Ile Val Asn Val Val
                245                 250                 255
Ser Lys Arg Pro Thr Asp Ser Pro Leu Arg Glu Leu Gln Leu Ser Gly
            260                 265                 270
Gly Ser His Ser Asn Arg Gln Leu Ala Gly Asp Phe Gly Gly Arg Ile
```

```
        275                 280                 285
Asp Asp Glu Gly Arg Leu Thr Tyr Arg Leu Thr Gly Leu Ala Arg Asn
    290                 295                 300
Ala Asp Thr Met Ile Asp His Val Pro Asp Asp Arg Tyr Tyr Leu Ala
305                 310                 315                 320
Pro Ala Leu Thr Trp Arg Ile Ser Pro Asp Thr Ser Leu Thr Leu Leu
                325                 330                 335
Ala Ser Tyr Met Lys Asn Lys Thr Ile Asn Asn Ala Gly Tyr Pro Leu
            340                 345                 350
Glu Gly Thr Val Lys Tyr Asn Pro Asn Gly Arg Ile Pro Arg His Arg
        355                 360                 365
Phe Thr Gly Glu Pro Asp Trp Ser Lys Trp Asp Gln Glu Val Ala Asn
    370                 375                 380
Val Gly Tyr Gln Phe Ala His Arg Phe Asn Asp Thr Trp Gln Phe Lys
385                 390                 395                 400
Gln Asn Leu Gly Tyr Ala Gln Ser Arg Asn Arg Val Asn His Ala Tyr
                405                 410                 415
Trp Trp Thr Trp Val Pro Gly Ser Asp Phe Ser Thr Ala Glu Arg Gly
            420                 425                 430
Ala Tyr Arg Arg Asp Asp Asp Ala His Gly Val Ser Ile Asp Asn Gln
        435                 440                 445
Phe Glu Ala Thr Trp Gln Ser Gly Arg Phe Arg His Asn Thr Leu Phe
    450                 455                 460
Gly Leu Asp Tyr Thr Glu Thr Ser Phe Thr Arg Lys Gln Tyr Ala Gly
465                 470                 475                 480
Tyr Asn Asn Leu Ala Pro Ile Asp Phe Phe Asp Pro Ala Tyr Gly Ser
                485                 490                 495
Asp Val Leu Leu Pro Ala Lys Pro Asp Thr Tyr Thr Asn Glu Lys Arg
            500                 505                 510
Ser Gln Leu Gly Leu Tyr Leu Gln Asp Gln Ile Lys Phe Asp Asp Lys
        515                 520                 525
Leu Val Val Val Leu Ser Gly Arg Tyr Asp Asn Ala Asp Gly Ser Thr
    530                 535                 540
Leu Asn Lys Leu Ser Gly Val Asn Thr Arg Thr Gly Asp Asn Ala Phe
545                 550                 555                 560
Thr Trp Arg Thr Gly Leu Leu Tyr Leu Ala Asp Asn Gly Leu Ala Pro
                565                 570                 575
Tyr Thr Ser Tyr Ser Thr Ser Phe Gln Pro Gln Ala Gly Thr Thr Ser
            580                 585                 590
Pro Ala Arg Gly Thr Thr Pro Phe Asp Pro Thr Lys Gly Lys Gln Trp
        595                 600                 605
Glu Ala Gly Val Lys Tyr Gln Pro Asn Gly Ser Asn Ser Phe Ile Thr
    610                 615                 620
Ala Ser Val Phe Glu Leu Thr Arg Thr Asn Val Pro Thr Thr Asp Pro
625                 630                 635                 640
Ala Asn Pro Val Tyr Ser Val Gln Glu Gly Glu Val Arg Ser Arg Gly
                645                 650                 655
Leu Glu Leu Ser Ala Thr Ala Asn Leu Ala Ser Gly Trp Asn Leu Ile
            660                 665                 670
Ala Ala Tyr Thr Tyr Thr Asp Ala Glu Ile Thr Lys Ser Asn Ser Asn
        675                 680                 685
Thr Leu Gly Asn Thr Pro Glu Ala Val Pro Arg Asn Met Ala Ser Leu
    690                 695                 700
Trp Ser Asp Tyr Thr Val Pro Ser Gly Ala Leu Ala Gly Leu Asn Ile
705                 710                 715                 720
Gly Ala Gly Val Arg Tyr Met Gly Ser Thr Tyr Asn Asn Thr Asn Ala
                725                 730                 735
Ala Lys Val Gly Asp Tyr Thr Val Phe Asp Ala Ala Leu Arg Tyr Asp
            740                 745                 750
Phe Gly Ala Arg Ser Pro Ser Leu Lys Gly Trp Thr Ala Asp Leu Thr
        755                 760                 765
```

```
Val Arg Asn Leu Phe Asp Lys Asp Tyr Val Ala Ser Cys Thr Tyr Ala
    770                 775                 780
Cys Phe Tyr Gly Glu Gly Arg Thr Val Leu Gly Arg Val Thr Tyr Lys
785                 790                 795                 800
Trp
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<210> 7
<211> 2307
<212> DNA
<213> Bordetella Pertussis

<400> 7

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aggccgcttg cgtggccgcg catccccctа cggacaacca ccatgaagcc attaccgctc 120
gcttatctcg ccgcgctgct gccctggtac gcaggcgtca tccaggcgca atccgcgccc 180
gccgccggcg acgatgcctc gatcaccctg gaagccgtca gggtcgaggc cagcgccgac 240
gcctccgccg gcggcctggc gccggccttc gcgggcggcc aggtcgccac gggcgcgaag 300
gtcggcatcc tcggcacgcg cgacaacctg gaaaccccgt tctccatcac cgcctacacc 360
aacgaactga tccaggaccg ccaggccaag ggggtgggcg acgtcctgca gaacgacccc 420
ggcgtgcggg tggcgcgcgg gttcggcaac ttccaggagt cgtatttcat ccgcggcttc 480
atcctcagct cggacgacat cgcgtacaac ggcctctatg gcctgttgcc gcgccagtac 540
atctcgaccc agctgttcga gcgcgtcgag gtgctgcgcg gtgcctcggc gtttctcacc 600
ggcgcgccgc cgtccggcgg cgggatcggc ggggtgatca acctggttcc caagcgcgcg 660
cccaacgagc cgctgacgcg cttttcggcc ggctacggca gcgacagcgt gctcgaggct 720
tcggccgaca tcggccggcg cttcggcccg gacgacagcg tcgggatccg catcaacgcc 780
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aaccgcctga agcgggcgcg ccccaatgtc acgctggccg gcgacgccgc caaggtgccc 960
ggcgcgcccg acgccggctc caactatgcc cagccctggt cgtactccaa cgaacgcgac 1020
gtgttcggca ccctgcgcgg cgaatacgac ttcaacggcc gcataacggg ctgggtcgcc 1080
tatggcatgc gccagagcaa ggaggagaac tcgctggcca acctcaataa cgtcaacggc 1140
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gagatcggcc tgcgcgccaa ggcgcgcacc ggcccggtgg gccacgaact ggtcgcctcg 1260
gcgtcgtatt tcgacctcga gaagaagaac gcctatgtca tggacttctt caaccagttc 1320
gacaccagca tctacgaccc cgtcagctac gccaagccgg ccatcagcag caccgcgttt 1380
cgcggcaacg acatggacga tcccgccaag cagggcgtca tccggctggc cagctatgcg 1440
ctgggcgaca ccatgtcgtt cttcgacgac aaggtgctgc tgaccgccgg catccgccac 1500
cagcgcctct accagcgcga ctacagctac gacacgggca tcggcggcac cccctacgag 1560
caaagccaca actcgcccgc cgccggcctg gtggtgcgcg tgacgcccca ggtgtcgctg 1620
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atcggcgtgc cccgcttcca ggccaacctc ggcgtggagt gggacatccc cggcgtgcag 2040
ggcctgaccg tggacgggcg tgtggtctat acgggctcgt cctatgcgga tgcggccaac 2100
accctcgagg tgccgggctg gacgcgcctg gacgccggcc tgcgttacat gaccgatatc 2160
ggcggccatc tggtgacctg gcgcgcccgc gtcgagaaca tcgccaaccg cgactactgg 2220
tcctccgtgg gcggctaccc cggcaatggc tacctggtgc tgggcggccc gcgcaccttc 2280
acgctgtcgg catcgatgga gttctga                                      2307
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<210> 8
<211> 768
<212> PRT
<213> Bordetella Pertussis

<400> 8

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Met Thr Gly Phe His Ala Arg Lys Pro Val Gly Gly Gly His Gly Arg
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Pro Ala His Gly Arg Pro Leu Ala Trp Pro Arg Ile Pro Leu Arg Thr
            20                  25                  30
Thr Thr Met Lys Pro Leu Pro Leu Ala Tyr Leu Ala Ala Leu Leu Pro
        35                  40                  45
Trp Tyr Ala Gly Val Ile Gln Ala Gln Ser Ala Pro Ala Ala Gly Asp
    50                  55                  60
Asp Ala Ser Ile Thr Leu Glu Ala Val Arg Val Glu Ala Ser Ala Asp
65                  70                  75                  80
Ala Ser Ala Gly Gly Leu Ala Pro Ala Phe Ala Gly Gly Gln Val Ala
                85                  90                  95
Thr Gly Ala Lys Val Gly Ile Leu Gly Thr Arg Asp Asn Leu Glu Thr
            100                 105                 110
Pro Phe Ser Ile Thr Ala Tyr Thr Asn Glu Leu Ile Gln Asp Arg Gln
        115                 120                 125
Ala Lys Gly Val Gly Asp Val Leu Gln Asn Asp Pro Gly Val Arg Val
    130                 135                 140
Ala Arg Gly Phe Gly Asn Phe Gln Glu Ser Tyr Phe Ile Arg Gly Phe
145                 150                 155                 160
Ile Leu Ser Ser Asp Asp Ile Ala Tyr Asn Gly Leu Tyr Gly Leu Leu
                165                 170                 175
Pro Arg Gln Tyr Ile Ser Thr Gln Leu Phe Glu Arg Val Glu Val Leu
            180                 185                 190
Arg Gly Ala Ser Ala Phe Leu Thr Gly Ala Pro Pro Ser Gly Gly Gly
        195                 200                 205
Ile Gly Gly Val Ile Asn Leu Val Pro Lys Arg Ala Pro Asn Glu Pro
    210                 215                 220
Leu Thr Arg Phe Ser Ala Gly Tyr Gly Ser Asp Ser Val Leu Glu Ala
225                 230                 235                 240
Ser Ala Asp Ile Gly Arg Arg Phe Gly Pro Asp Asp Ser Val Gly Ile
                245                 250                 255
Arg Ile Asn Ala Ala Gln Arg Gly Gly Glu Thr Ala Ile Asp Gly Glu
            260                 265                 270
Arg Thr Arg Thr Thr Val Phe Ala Leu Gly Leu Asp Trp Arg Gly Glu
        275                 280                 285
Arg Ala Arg Leu Ser Ala Asp Ile Gly Tyr Gln Asp Asn Arg Leu Lys
    290                 295                 300
Arg Ala Arg Pro Asn Val Thr Leu Ala Gly Asp Ala Ala Lys Val Pro
305                 310                 315                 320
Gly Ala Pro Asp Ala Gly Ser Asn Tyr Ala Gln Pro Trp Ser Tyr Ser
                325                 330                 335
Asn Glu Arg Asp Val Phe Gly Thr Leu Arg Gly Glu Tyr Asp Phe Asn
            340                 345                 350
Gly Arg Ile Thr Gly Trp Val Ala Tyr Gly Met Arg Gln Ser Lys Glu
        355                 360                 365
Glu Asn Ser Leu Ala Asn Leu Asn Asn Val Asn Gly Ala Gly Gln Gly
    370                 375                 380
Lys Phe Tyr Arg Phe Asp Asn Ala Arg Glu Asp Thr Val Asn Thr Gly
385                 390                 395                 400

Glu Ile Gly Leu Arg Ala Lys Ala Arg Thr Gly Pro Val Gly His Glu
                405                 410                 415
Leu Val Ala Ser Ala Ser Tyr Phe Asp Leu Glu Lys Lys Asn Ala Tyr
            420                 425                 430
Val Met Asp Phe Phe Asn Gln Phe Asp Thr Ser Ile Tyr Asp Pro Val
        435                 440                 445
Ser Tyr Ala Lys Pro Ala Ile Ser Ser Thr Ala Phe Arg Gly Asn Asp
    450                 455                 460
Met Asp Asp Pro Ala Lys Gln Gly Val Ile Arg Leu Ala Ser Tyr Ala
465                 470                 475                 480
Leu Gly Asp Thr Met Ser Phe Phe Asp Asp Lys Val Leu Leu Thr Ala
```

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                485                 490                 495
Gly Ile Arg His Gln Arg Leu Tyr Gln Arg Asp Tyr Ser Tyr Asp Thr
            500                 505                 510
Gly Ile Gly Gly Thr Pro Tyr Glu Gln Ser His Asn Ser Pro Ala Ala
        515                 520                 525
Gly Leu Val Val Arg Val Thr Pro Gln Val Ser Leu Tyr Ala Asn Tyr
    530                 535                 540
Ile Glu Ala Leu Ser Ala Gly Asp Thr Ala Pro Gln Thr Ala Asn Gly
545                 550                 555                 560
Leu Pro Val Val Asn His Gly Glu Ser Leu Ala Pro Tyr Val Ser Lys
                565                 570                 575
Gln Lys Glu Val Gly Val Lys Phe Glu His Asp Gly Leu Gly Gly Gly
            580                 585                 590
Leu Ala Leu Phe Ser Thr Asp Lys Pro Arg Gly Phe Val Gly Asp Asp
        595                 600                 605
Gln Val Phe Arg Ala Ser Gly Lys Asp Arg His Arg Gly Val Glu Leu
    610                 615                 620
Thr Thr Tyr Gly Glu Leu Thr Arg Ser Val Arg Val Leu Gly Gly Leu
625                 630                 635                 640
Thr Trp Leu Asp Ala Lys Gln Leu Ser Thr Gly Asn Ala Ala Thr Asp
                645                 650                 655
Gly Lys Arg Val Ile Gly Val Pro Arg Phe Gln Ala Asn Leu Gly Val
            660                 665                 670
Glu Trp Asp Ile Pro Gly Val Gln Gly Leu Thr Val Asp Gly Arg Val
        675                 680                 685
Val Tyr Thr Gly Ser Ser Tyr Ala Asp Ala Ala Asn Thr Leu Glu Val
    690                 695                 700
Pro Gly Trp Thr Arg Leu Asp Ala Gly Leu Arg Tyr Met Thr Asp Ile
705                 710                 715                 720
Gly Gly His Leu Val Thr Trp Arg Ala Arg Val Glu Asn Ile Ala Asn
                725                 730                 735
Arg Asp Tyr Trp Ser Ser Val Gly Gly Tyr Pro Gly Asn Gly Tyr Leu

            740                 745                 750
Val Leu Gly Gly Pro Arg Thr Phe Thr Leu Ser Ala Ser Met Glu Phe
        755                 760                 765
```

<210> 9
<211> 2190
<212> DNA
<213> Bordetella Pertussis

<400> 9

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gtgcctcgtc ctacttcccg ccgtacgcgc cctgcgcgcc ggcaggcgca gcccgccttc 60
gtgcccgcgc tcttcatgct tgccctgggc gccgttgccg ccggcgcgcg cgcccagccc 120
gctgcggcgg gtgtcccgga tacgcaaggc gtggcgcaaa tgccggccgt cacggtcaac 180
gccgcgccgg tggacgacac gctggagcat ctggaggcgc cggtcgatac cggcgcgctg 240
ggacggcgca cccagctgga gacgcctttt tccaccacgg tggtgactgc ccgcgacatg 300
gaggagcgcc aggtcaacaa gctgggagac gtgttcgcgc tggatgcctc ggtgacggac 360
aacagcgcgt cctatggcgc gtgggccagc tacctgacgg tgcgcggcct gccgctggat 420

tggcagaatt cgtaccgcat cgatggccgg ccgttcctga gctacgtcac gacgctgccg 480
ttcgagcact tcgagcagat cgacctgctc aaggggcgt cgggcttcat gtacggtttc 540
ggctcgccgg gcggcctggt caactatgtc accaagaagc cgaccgacga agcggtgcgc 600
agcgtcgagc tgggctacgt gtccaagggg ttgctgcgcg agcacgtgga cctgggcggc 660
agggtgggcc agagcggcgc gtttggctat cggctgaatg ccacgcacga ggagggcaat 720
acctacaacg gtggatcgct gtaccgcgat tcggtgtcgc tggcgctgga tgcgcgcctg 780
agcgaccggt tgacctggga cttccaatcc atctaccagg accgcaaggc catcgggcag 840
gagcccacga tctatgcggg caccatggcc ggcagcgagt tgccatcgcc ggtgcgcaac 900
gacaatgaca ggctggtcgg gcagggaccg tatgcggaca atgcgttccg ctattactcg 960
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accggcttga agtaccaatt ggcggacgaa tggacgctga gcaccaatta cagctacagc 1020
tccacgcgta cccgccgcaa cgagtcggtg ctgttcctgc gcgaccaggc gggcgactat 1080
gacgattacc gctcggacta tggcgaggcc tatggctaca accagtggca ggccatgctg 1140
gagggcaagt tcgctaccgg tcccttgaag caccacgtgg tggccggcgc gtcgtggcag 1200
aagcagaaga acgactacag cgccaacggg gtctatcaat tgcagggcac gggcaacctg 1260
cgcgcgcgca ataccaacac gtactacagc gaaggccagc tgcacctgta ccgcgcggcc 1320
gagatcacgc agaaggcgct gttcgccagc gacacggtcg acctgaccgg cggctggtcg 1380
gtgctgggcg ggctgcgcta tacgaattat gcgcagcaag gattcgatgc cacgggcgcg 1440
cgaacatcgc gctacgacaa gaacggcgtg ctgacgccga cctttgccct gatgtacaag 1500
ctgacgccgc gcaccatggc ctatgccagc tacatcgaat ccttggagcc gggctcgtcg 1560
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gggctgaagc tgcgcgccga tgtgaagtac accggcaaca cgatgctggg cgccagcaac 1980
cgggtgcagg tggacgacta cgccatcgtc aatatcggcg ccacctacga cacgcagatc 2040
cacggctacg aggcgacctt caccgccggc atcaacaacg tggccaacaa gcgctactgg 2100
ctgtaccagt cgtctgacta cgtgaaggcg ggcgacccgc ggacctatgg cctgacgtct 2160
atatccagat atccggatat ctggatataa 2190

<210> 10
<211> 729
<212> PRT
<213> Bordetella Pertussis

<400> 10
Val Pro Arg Pro Thr Ser Arg Arg Thr Arg Pro Ala Arg Arg Gln Ala
 1   5   10   15
Gln Pro Ala Phe Val Pro Ala Leu Phe Met Leu Ala Leu Gly Ala Val
            20   25   30
Ala Ala Gly Ala Arg Ala Gln Pro Ala Ala Ala Gly Val Pro Asp Thr
        35   40   45
Gln Gly Val Ala Gln Met Pro Ala Val Thr Val Asn Ala Ala Pro Val
    50   55   60
Asp Asp Thr Leu Glu His Leu Glu Ala Pro Val Asp Thr Gly Ala Leu
65   70   75   80
Gly Arg Arg Thr Gln Leu Glu Thr Pro Phe Ser Thr Thr Val Val Thr
                85   90   95
Ala Arg Asp Met Glu Glu Arg Gln Val Asn Lys Leu Gly Asp Val Phe
            100   105   110
Ala Leu Asp Ala Ser Val Thr Asp Asn Ser Ala Ser Tyr Gly Ala Trp
        115   120   125
Ala Ser Tyr Leu Thr Val Arg Gly Leu Pro Leu Asp Trp Gln Asn Ser
    130   135   140
Tyr Arg Ile Asp Gly Arg Pro Phe Leu Ser Tyr Val Thr Thr Leu Pro
145   150   155   160
Phe Glu His Phe Glu Gln Ile Asp Leu Leu Lys Gly Ala Ser Gly Phe
                165   170   175
Met Tyr Gly Phe Gly Ser Pro Gly Gly Leu Val Asn Tyr Val Thr Lys
            180   185   190
Lys Pro Thr Asp Glu Ala Val Arg Ser Val Glu Leu Gly Tyr Val Ser
        195   200   205
Lys Gly Leu Leu Arg Glu His Val Asp Leu Gly Gly Arg Val Gly Gln
    210   215   220
Ser Gly Ala Phe Gly Tyr Arg Leu Asn Ala Thr His Glu Glu Gly Asn
225   230   235   240
Thr Tyr Asn Gly Gly Ser Leu Tyr Arg Asp Ser Val Ser Leu Ala Leu
                245   250   255
Asp Ala Arg Leu Ser Asp Arg Leu Thr Trp Asp Phe Gln Ser Ile Tyr

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            260                 265                 270
Gln Asp Arg Lys Ala Ile Gly Gln Glu Pro Thr Ile Tyr Ala Gly Thr
        275                 280                 285
Met Ala Gly Ser Glu Leu Pro Ser Pro Val Arg Asn Asp Asn Asp Arg
    290                 295                 300
Leu Val Gly Gln Gly Pro Tyr Ala Asp Asn Ala Phe Arg Tyr Tyr Ser
305                 310                 315                 320
Thr Gly Leu Lys Tyr Gln Leu Ala Asp Glu Trp Thr Leu Ser Thr Asn
                325                 330                 335
Tyr Ser Tyr Ser Ser Thr Arg Thr Arg Arg Asn Glu Ser Val Leu Phe
            340                 345                 350
Leu Arg Asp Gln Ala Gly Asp Tyr Asp Asp Tyr Arg Ser Asp Tyr Gly
        355                 360                 365
Glu Ala Tyr Gly Tyr Asn Gln Trp Gln Ala Met Leu Glu Gly Lys Phe
    370                 375                 380
Ala Thr Gly Pro Leu Lys His His Val Val Ala Gly Ala Ser Trp Gln
385                 390                 395                 400
Lys Gln Lys Asn Asp Tyr Ser Ala Asn Gly Val Tyr Gln Leu Gln Gly
                405                 410                 415
Thr Gly Asn Leu Arg Ala Arg Asn Thr Asn Thr Tyr Tyr Ser Glu Gly
            420                 425                 430
Gln Leu His Leu Tyr Arg Ala Ala Glu Ile Thr Gln Lys Ala Leu Phe
        435                 440                 445
Ala Ser Asp Thr Val Asp Leu Thr Gly Gly Trp Ser Val Leu Gly Gly
    450                 455                 460
Leu Arg Tyr Thr Asn Tyr Ala Gln Gln Gly Phe Asp Ala Thr Gly Ala
465                 470                 475                 480
Arg Thr Ser Arg Tyr Asp Lys Asn Gly Val Leu Thr Pro Thr Phe Ala
                485                 490                 495
Leu Met Tyr Lys Leu Thr Pro Arg Thr Met Ala Tyr Ala Ser Tyr Ile
            500                 505                 510
Glu Ser Leu Glu Pro Gly Ser Ser Val Gly Ala Ala Tyr Ala Asn Phe
        515                 520                 525
Gly Ala Leu Leu Asp Pro Leu Lys Ser Lys Gln Tyr Glu Leu Gly Ile
    530                 535                 540
Lys Thr Glu Gln Asp Gly Trp Ala Ala Thr Ala Ala Leu Phe Arg Ile
545                 550                 555                 560
Glu Lys Lys Ala Glu Tyr Ala Asn Ala Ala Asn Glu Leu Val Gln Asp
                565                 570                 575
Gly Lys Thr Leu Tyr Gln Gly Leu Glu Leu Gly Ala Ser Thr Arg Ile
            580                 585                 590
Ala Arg Asp Trp Asn Val Gly Gly Ser Leu Met Leu Leu Asp Ser Glu
        595                 600                 605
Tyr Lys Lys Gly Ser Asp Phe Thr Gly Asn Arg Val Ala Gly Ala Pro
    610                 615                 620
Lys Phe Val Ala Ala Ala Gln Leu Ala Tyr Ser Val Pro Gln Val Pro
625                 630                 635                 640
Gly Leu Lys Leu Arg Ala Asp Val Lys Tyr Thr Gly Asn Thr Met Leu
                645                 650                 655
Gly Ala Ser Asn Arg Val Gln Val Asp Asp Tyr Ala Ile Val Asn Ile
            660                 665                 670
Gly Ala Thr Tyr Asp Thr Gln Ile His Gly Tyr Glu Ala Thr Phe Thr
        675                 680                 685
Ala Gly Ile Asn Asn Val Ala Asn Lys Arg Tyr Trp Leu Tyr Gln Ser
    690                 695                 700
Ser Asp Tyr Val Lys Ala Gly Asp Pro Arg Thr Tyr Gly Leu Thr Ser
705                 710                 715                 720
Ile Ser Arg Tyr Pro Asp Ile Trp Ile
                725
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<210> 11
<211> 2067
<212> DNA
<213> Bordetella Pertussis

<400> 11
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caatccgtca gtgtggtcac ccgacagcag atcgaggatc agggcctcac cgacaccggc 180
gccatcctgg cgaccgcgcc agggatttcc gtcacgcgca gcgacagcaa ccgctattca 240
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ctgagccaat ggaactatgg ttcgaccgat atggacgccg ccatctacga tcacgtggaa 360
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ttcgtgcgca agcgtccctt gcgtgagttc gcggctacgt tcaatgcgag tgtcggcagc 480
tgggactatg tgcgcggcga tgccgacatc tccgtgccca tcacggaaga cggcagaata 540
cggtcacgct tggtggccgc ctacagtcag ggcgacagct atgtgcactt tttagatacg 600
cgccggcgca cattctatgg cgtggtcagc gccgatctga cgccggatac ggtgctgacg 660
accagcgtgg agtaccagca caaccacagc aatgggtttg gcagcggctt tccgctgttc 720
tatagcgacg gttcgcgcac cgatttcaac cgctcggtgg ccaacaacgc tccctgggcc 780
cggcaggata ccgaagccac cacctatttc gtggacctca cgcaccgctt caccaatgac 840
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cggggcggct accccgatcg ccatactggc atcatcgctg ccccccctgc attttccaac 960
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agtccgcgcg gcaatgtcga agtcgaacag gacagctacg cactcgtgag cctcatggcg 1920
cgcttcgact ttaacaaaaa actgtcggca acactgaacg tgaacaatct gttcgacaaa 1980
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<210> 12
<211> 688
<212> PRT
<213> Bordetella Pertussis

<400> 12
Leu Pro Ala Ile Ser Val Thr Gly Arg Glu Ile Ser Asp Leu Thr Glu
 1   5   10   15
Gly Thr Asn Ala Tyr Thr Thr Glu Ala Met Ser Thr Ala Thr Gly Leu
            20   25   30
Thr Leu Ser Pro Arg Glu Thr Pro Gln Ser Val Ser Val Val Thr Arg
        35   40   45
Gln Gln Ile Glu Asp Gln Gly Leu Thr Asp Thr Gly Ala Ile Leu Ala
    50   55   60
Thr Ala Pro Gly Ile Ser Val Thr Arg Ser Asp Ser Asn Arg Tyr Ser
65   70   75   80
Phe Ser Ala Arg Gly Phe Thr Ile Asp Asn Phe Gln Phe Asp Gly Leu
                85   90   95
Val Ser Pro Ile Leu Ser Gln Trp Asn Tyr Gly Ser Thr Asp Met Asp

```
                100                 105                 110
Ala Ala Ile Tyr Asp His Val Glu Ile Val Arg Gly Ala Thr Gly Leu
        115                 120                 125
Met Thr Gly Ser Gly Asn Pro Ser Ala Ala Val Asn Phe Val Arg Lys
    130                 135                 140
Arg Pro Leu Arg Glu Phe Ala Ala Thr Phe Asn Ala Ser Val Gly Ser
145                 150                 155                 160
Trp Asp Tyr Val Arg Gly Asp Ala Asp Ile Ser Val Pro Ile Thr Glu
                165                 170                 175
Asp Gly Arg Ile Arg Ser Arg Leu Val Ala Ala Tyr Ser Gln Gly Asp
            180                 185                 190
Ser Tyr Val His Phe Leu Asp Thr Arg Arg Arg Thr Phe Tyr Gly Val
        195                 200                 205
Val Ser Ala Asp Leu Thr Pro Asp Thr Val Leu Thr Thr Ser Val Glu
    210                 215                 220
Tyr Gln His Asn His Ser Asn Gly Phe Gly Ser Gly Phe Pro Leu Phe
225                 230                 235                 240
Tyr Ser Asp Gly Ser Arg Thr Asp Phe Asn Arg Ser Val Ala Asn Asn
                245                 250                 255
Ala Pro Trp Ala Arg Gln Asp Thr Glu Ala Thr Thr Tyr Phe Val Asp
            260                 265                 270
Leu Thr His Arg Phe Thr Asn Asp Trp Lys Leu Arg Ala Ala Tyr Ser
        275                 280                 285
His Thr Asp Gly Arg Tyr Leu Met Lys His Val Tyr Arg Gly Gly Tyr
    290                 295                 300
Pro Asp Arg His Thr Gly Ile Ile Ala Ala Pro Pro Ala Phe Ser Asn
305                 310                 315                 320
Tyr Asp Gly Asn Leu Asp Arg Asp Asp Ile His Phe Ser Leu Ser Ala
                325                 330                 335
Pro Phe Glu Ala Phe Gly Leu Arg His Glu Val Ala Leu Gly Trp Met
            340                 345                 350
Ser Ile Asp Asn His Ser Asp Ile Gln Arg Tyr Ala Met Val Gly Pro
        355                 360                 365
Ala Pro Ala Ile Gly Ser Phe Phe Asp Trp Arg Arg Ala His Ile Gln
    370                 375                 380
Glu Pro Ser Trp Ala Asp Thr Leu Ser Pro Ala Asp Asp Val Arg Thr
385                 390                 395                 400
Lys Gln Thr Gly Ala Tyr Leu Val Gly Arg Phe Ala Leu Ala Glu Pro
                405                 410                 415
Leu His Leu Ile Val Gly Asp Arg Trp Ser Asp Trp Lys Thr Lys Gln
            420                 425                 430
Met Tyr Phe Gly Ser Arg Arg Glu Tyr Arg Ile Lys Asn Gln Phe Thr
        435                 440                 445
Pro Tyr Ala Gly Leu Thr Tyr Asp Ile Asn Asp Thr Tyr Thr Ala Tyr
    450                 455                 460
Ala Ser Tyr Thr Glu Ile Phe Gln Pro Gln Asn Ala Arg Asp Thr Ser
465                 470                 475                 480
Gly Gly Ile Leu Pro Pro Ile Lys Ser Lys Ser Tyr Glu Leu Gly Leu
                485                 490                 495
Lys Ala Ala Tyr Leu Glu Gly Arg Leu Asn Thr Ser Ala Ala Leu Phe
            500                 505                 510
Gln Thr Arg Gln Asp Asn Leu Ala Gln Val Ile Pro Gly Ser Ser Ile
        515                 520                 525
Pro Gly Phe Pro Asn Met Gln Ala Ser Arg Ala Ala Ser Gly Ala Lys
    530                 535                 540
Val Glu Gly Ile Asp Leu Glu Ala Ser Gly Gln Ile Leu Pro Asp Trp
545                 550                 555                 560
Asn Ile Gly Ala Ser Tyr Thr His Phe Thr Thr Lys Asp Ala Ser Gly
                565                 570                 575
Asn Pro Ile Asn Thr Asn His Pro Arg Ser Leu Phe Lys Leu Tyr Thr
            580                 585                 590
```

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Thr Tyr Arg Leu Pro Gly Ala Leu His Arg Leu Thr Val Gly Gly Gly
        595                 600                 605
Val Asp Trp Gln Ser Arg Met Tyr Gln Ala Ala Ala Ser Pro Arg Gly
    610                 615                 620
Asn Val Glu Val Glu Gln Asp Ser Tyr Ala Leu Val Ser Leu Met Ala
625                 630                 635                 640
Arg Phe Asp Phe Asn Lys Lys Leu Ser Ala Thr Leu Asn Val Asn Asn
                645                 650                 655
Leu Phe Asp Lys Lys Tyr Tyr Asp Gln Ile Gly Phe Tyr Ser Gln Gly
            660                 665                 670
Trp Trp Gly Ala Pro Arg Asn Val Met Leu Asn Leu Arg Ala Gln Tyr
        675                 680                 685
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<210> 13
<211> 2232
<212> DNA
<213> Bordetella Pertussis

<400> 13
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ctgttgggcc tgctgccggc ggcgcaggcc gcgtccacgg cggtccagct gccatccgtc 120
acggtcgagg gcgagtactc gtcctatcaa ccggaaagcg cccagtcgcc caagttcacc 180
gcgcccctgg cggacacgcc gcgcacggtg caggtcatcc ctgagcggct catccaggac 240
caggggccca gcgacctcga agcggtactg cgcaatgcgc cagggatatc gatgaccgcc 300
ggcgaaggcg gccgtccggc cagcgacctg ccgttcatcc gcggccagaa ttcggccagc 360
agccttttg tcgacggcct gcgcgatccc agcacgcaat cgcgcgatac cttcaacctg 420
gaacaggtcg acgtcgtcaa ggggcccgat tcggtatttt ccgggcgcgg cggcgccggc 480
ggaagcatca acctcgtcac caagacgccc aggaaccagg atttcaccga agtccaggcc 540
ggcatcggga cggccgagac ctaccgaggc accatagacg gcaactgggt gctgggcgag 600
aacacggcgc tgcgcctcaa cctgctgggc accagggaca ccgtgccggg ccgcgacaag 660
gcggtcgagt tcagccgcgt gggtatcgcg ccatcgctgc gcctgggcct gagcggcccc 720
acccgcgtga cgctgggcct gtaccactat cgccaccggc gggttcccga ttattcgatt 780
ccgtacgatc cgcgcaccgg cacgccgatc accgagacca tcggcgtcag ccgccgcaac 840
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acggtggagc agatcaccac catgcccgaa ctgaaaaccg ccgatctggc caaggggctg 1020
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tgctcgcccg tgacggacgg caacaatccc gccctgtgcg cctcgctccg ggatccggat 1260
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aagccgcccg tctacgagcg tgccgcgcgc accgacaacc tgttcaacta ccagctcggc 1500
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ccgtcggccg tgtccgacta cgccccggcg gacagcatct ccggcacaag ccagcagctc 1620
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aagcacctta cggcccagtt gaacgtctac aacctgctcg acaagaccta ttacgccaag 2160
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ctgagctact ga 2232

<210> 14
<211> 743

<212> PRT
<213> Bordetella Pertussis

<400> 14
Met Lys Phe Tyr Ser Ser His Pro Met Pro Glu Ser Leu Ala Ala Ala
 1   5   10   15
Ile Ala Val Pro Leu Leu Gly Leu Leu Pro Ala Ala Gln Ala Ala Ser
            20   25   30
Thr Ala Val Gln Leu Pro Ser Val Thr Val Glu Gly Glu Tyr Ser Ser
        35   40   45
Tyr Gln Pro Glu Ser Ala Gln Ser Pro Lys Phe Thr Ala Pro Leu Ala
    50   55   60
Asp Thr Pro Arg Thr Val Gln Val Ile Pro Glu Arg Leu Ile Gln Asp
65   70   75   80
Gln Gly Ala Ser Asp Leu Glu Ala Val Leu Arg Asn Ala Pro Gly Ile
                85   90   95
Ser Met Thr Ala Gly Glu Gly Gly Arg Pro Ala Ser Asp Leu Pro Phe
            100   105   110
Ile Arg Gly Gln Asn Ser Ala Ser Ser Leu Phe Val Asp Gly Leu Arg
        115   120   125
Asp Pro Ser Thr Gln Ser Arg Asp Thr Phe Asn Leu Glu Gln Val Asp
    130   135   140
Val Val Lys Gly Pro Asp Ser Val Phe Ser Gly Arg Gly Gly Ala Gly
145   150   155   160
Gly Ser Ile Asn Leu Val Thr Lys Thr Pro Arg Asn Gln Asp Phe Thr
                165   170   175
Glu Val Gln Ala Gly Ile Gly Thr Ala Glu Thr Tyr Arg Gly Thr Ile
            180   185   190
Asp Gly Asn Trp Val Leu Gly Glu Asn Thr Ala Leu Arg Leu Asn Leu
        195   200   205
Leu Gly Thr Arg Asp Thr Val Pro Gly Arg Asp Lys Ala Val Glu Phe
    210   215   220
Ser Arg Val Gly Ile Ala Pro Ser Leu Arg Leu Gly Leu Ser Gly Pro
225   230   235   240
Thr Arg Val Thr Leu Gly Leu Tyr His Tyr Arg His Arg Arg Val Pro
                245   250   255
Asp Tyr Ser Ile Pro Tyr Asp Pro Arg Thr Gly Thr Pro Ile Thr Glu
            260   265   270
Thr Ile Gly Val Ser Arg Arg Asn Phe Tyr Gly Leu Val Arg Arg Asp
        275   280   285
Ser Gly Asp Thr Glu Asp Tyr Ala Ala Thr Val Lys Trp Glu His Asp
    290   295   300
Leu Ala Asn Gly Phe Lys Val Glu Asn Leu Ala Arg Tyr Ser Arg Ala
305   310   315   320
Thr Val Glu Gln Ile Thr Thr Met Pro Glu Leu Lys Thr Ala Asp Leu
                325   330   335
Ala Lys Gly Leu Val Tyr Arg Asn Leu Arg Ala Ser Tyr Gln Val Asn
            340   345   350
Asp Ser Phe Ala Asn Arg Thr Asp Leu Arg Gly Thr Phe Asp Thr Gly
        355   360   365
Gln Trp Arg His Thr Phe Asp Leu Gly Gly Glu Phe Ala Thr Ser Arg
    370   375   380
Arg Ser Arg Asp Arg Tyr Lys Gln Glu Ile Pro Asp Ala Ala Ser Pro
385   390   395   400
Cys Ser Pro Val Thr Asp Gly Asn Asn Pro Ala Leu Cys Ala Ser Leu
                405   410   415
Arg Asp Pro Asp Pro His Val Asp Phe Pro Gly Thr Val Arg Arg Asn
            420   425   430
His Asn Pro Ala Arg Tyr His Thr Asp Ile Leu Ser Leu Tyr Gly Phe
        435   440   445
Asp Thr Ile Ala Phe Asp Glu Gln Trp Gln Leu Asn Leu Gly Leu Arg

```
    450                 455                 460
Trp Asp His Tyr Lys Thr Ser Gly Arg Asn Leu Pro Val Arg Gly Ala
465                 470                 475                 480
Lys Pro Pro Val Tyr Glu Arg Ala Ala Arg Thr Asp Asn Leu Phe Asn
                485                 490                 495
Tyr Gln Leu Gly Leu Val Tyr Lys Pro Arg Pro Asp Gly Ser Val Tyr
            500                 505                 510
Ala Ser Tyr Gly Thr Ala Ser Thr Pro Ser Ala Val Ser Asp Tyr Ala
        515                 520                 525
Pro Ala Asp Ser Ile Ser Gly Thr Ser Gln Gln Leu Lys Pro Glu Arg
    530                 535                 540
Ser Glu Ala Ile Glu Ile Gly Thr Lys Trp Gln Val Leu Asp Arg Arg
545                 550                 555                 560
Leu Leu Val Thr Gly Ala Met Phe Arg Glu Thr Arg Lys Asn Thr Ser
                565                 570                 575
Ile Glu Val Ala Glu Gly Leu Arg Ala Pro Ala Gly Lys Ser Arg Val
            580                 585                 590
Thr Gly Met Glu Leu Gly Val Ala Gly Ser Leu Thr Pro Arg Trp Asp
        595                 600                 605
Val Tyr Gly Gly Tyr Ala Leu Leu Asp Ser Lys Leu Val Arg Ala Ser
    610                 615                 620
His Lys Ser Gly Ala Gln Gly Gln Pro Leu Pro Ser Ala Pro Arg His
625                 630                 635                 640
Ala Phe Ser Ile Trp Ser Thr Tyr Lys Leu Leu Pro Glu Leu Thr Val
                645                 650                 655
Gly Ala Gly Ala Phe Tyr Arg Ser Lys Val Tyr Gly Asn Ala Asp Ala
            660                 665                 670
Gly Tyr Asn Lys Asp Gly Thr Pro Lys Ala Arg Trp Val Pro Ala Tyr
        675                 680                 685
Trp Arg Phe Asp Ala Met Ala Ala Tyr Gln Leu Asn Lys His Leu Thr
    690                 695                 700
Ala Gln Leu Asn Val Tyr Asn Leu Leu Asp Lys Thr Tyr Tyr Ala Lys
705                 710                 715                 720
Thr Tyr Arg Ser His Tyr Ala Ala Leu Gly Pro Gly Arg Ser Ala Met
                725                 730                 735
Leu Thr Phe Lys Leu Ser Tyr
            740
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<210> 15
<211> 2271
<212> DNA
<213> Bordetella Pertussis

<400> 15

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atggagaagc cgttgaaatc cctggactcg tattcagcga gcacgctcgc caactcgctg 60
gccgccgcca ttgcggtgcc ggccctgtgc ctgatgcccg gtgctcaggc acagaccagc 120
gcgggcgtta cccaattggc gccggtgcag gtagagggcg aagcgtcccc ctatcaggcc 180
accaccgtcc agtcgtccaa gatgacggcg cccttgctgg atacgcccag gaccgtgcag 240
gtcgtgccgc agcaggtcat ccaggaccag gccgccacca atctgcagga cgtgctgcgc 300
aactcgccgg gcatcaccat gggcgccggc gagggcgggc gcgccggcgg cgacctgccc 360
atcatccggg gccagaatgc ggcgggcagc atcttcgtcg acggcgtgcg cgaccccagc 420
acccagatac gcgatacgtt caacctggag caggtcgaga tcatcaaggg gcctgattcg 480
gtctactccg gccgcggcgg agccggcggc agcatcaacc tggtcagcaa gacgccgaag 540
gcgcgcgact tcgccgaggg ctcggtgcag atcggcaccg acagcaatta ccgcgccacc 600
gccgacggca actggctgct gggcgacaac gccgccttcc gcctgaacct gatgggcaac 660
aagggcgacg tgccgggccg cgaccatgcg gtcgatttca gccgctgggg cgtggcgccc 720
accctgcaac tgggcgtggg cacgcccacc cgcatcaccc tggggtacta ccactaccag 780
gatgacagca tgcccgatta cgcgatcccg tacgatccga agtcggggca gccggtcacc 840
gagacccagg gcgtcagccg caagaatttc tacgggctga ccggccgcga cttcatgaag 900
tcgcgcgacg acgtggccac gctggccatc gatcacgatt tcagcagcaa gctgcgcctg 960
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cgcaacgtca cccgctacgg gcgctcggtg accgactacg ccgccaccaa tccggatgac 1020
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aacaagacgt tcaccaacca gaccgacctg agcggcgaat tcgagacggg cagcctgcag 1140
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cagactatcg ccaagggcgc gatgccttgc aaggtgggcg ccaacgatgc cagcaatccg 1260
gccttgtgca cctcgctgtg ggatccggat ccgcatgact attatcccgg ccacctgtcg 1320
cgcaacgaca acccggcccg ctattccacc gacacgatcg cgctctacgg cttcgacacg 1380
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accagccgcg aagacaatct gttcaattac cagctgggcc tggcctacaa gccggtgccc 1560
aacggcacga tctacgcctc gtatggcacc tcgtcgacgc cgtcggccgt cgccggctcg 1620
aacgtgagcg acgccgtgac ggtgagcaac gagtcgctgg cgccggagaa aagccgcacc 1680
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ggcaacgcgg acaacggtcg caatgccgac ggcacgccga aggcgcgctg ggtaccgtcg 2100
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aacgtgatga acatcttcga caagacgtac tacaccaagg cctacgcggc gcactacgcg 2220
gcgctgggca cgggccgcgc cgcggtgctg tcgttcaata tcaagtattg a          2271
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<210> 16
<211> 756
<212> PRT
<213> Bordetella Pertussis

<400> 16

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Met Glu Lys Pro Leu Lys Ser Leu Asp Ser Tyr Ser Ala Ser Thr Leu
 1               5                  10                  15
Ala Asn Ser Leu Ala Ala Ala Ile Ala Val Pro Ala Leu Cys Leu Met
            20                  25                  30
Pro Gly Ala Gln Ala Gln Thr Ser Ala Gly Val Thr Gln Leu Ala Pro
        35                  40                  45
Val Gln Val Glu Gly Glu Ala Ser Pro Tyr Gln Ala Thr Thr Val Gln
    50                  55                  60
Ser Ser Lys Met Thr Ala Pro Leu Leu Asp Thr Pro Arg Thr Val Gln
65                  70                  75                  80
Val Val Pro Gln Gln Val Ile Gln Asp Gln Ala Ala Thr Asn Leu Gln
                85                  90                  95
Asp Val Leu Arg Asn Ser Pro Gly Ile Thr Met Gly Ala Gly Glu Gly
            100                 105                 110
Gly Arg Ala Gly Gly Asp Leu Pro Ile Ile Arg Gly Gln Asn Ala Ala
        115                 120                 125
Gly Ser Ile Phe Val Asp Gly Val Arg Asp Pro Ser Thr Gln Ile Arg
    130                 135                 140
Asp Thr Phe Asn Leu Glu Gln Val Glu Ile Ile Lys Gly Pro Asp Ser
145                 150                 155                 160
Val Tyr Ser Gly Arg Gly Gly Ala Gly Gly Ser Ile Asn Leu Val Ser
                165                 170                 175
Lys Thr Pro Lys Ala Arg Asp Phe Ala Glu Gly Ser Val Gln Ile Gly
            180                 185                 190
Thr Asp Ser Asn Tyr Arg Ala Thr Ala Asp Gly Asn Trp Leu Leu Gly
        195                 200                 205
Asp Asn Ala Ala Phe Arg Leu Asn Leu Met Gly Asn Lys Gly Asp Val
    210                 215                 220
Pro Gly Arg Asp His Ala Val Asp Phe Ser Arg Trp Gly Val Ala Pro
225                 230                 235                 240
Thr Leu Gln Leu Gly Val Gly Thr Pro Thr Arg Ile Thr Leu Gly Tyr
                245                 250                 255
```

```
Tyr His Tyr Gln Asp Asp Ser Met Pro Asp Tyr Ala Ile Pro Tyr Asp
            260                 265                 270
Pro Lys Ser Gly Gln Pro Val Thr Glu Thr Gln Gly Val Ser Arg Lys
        275                 280                 285
Asn Phe Tyr Gly Leu Thr Gly Arg Asp Phe Met Lys Ser Arg Asp Asp
    290                 295                 300
Val Ala Thr Leu Ala Ile Asp His Asp Phe Ser Ser Lys Leu Arg Leu
305                 310                 315                 320
Arg Asn Val Thr Arg Tyr Gly Arg Ser Val Thr Asp Tyr Ala Ala Thr
                325                 330                 335
Asn Pro Asp Asp Ser Lys Gly Asn Val Pro Asn Gly Leu Val Tyr Arg
            340                 345                 350
Ala Leu Lys Ala Gly Tyr Tyr Thr Asn Lys Thr Phe Thr Asn Gln Thr
        355                 360                 365
Asp Leu Ser Gly Glu Phe Glu Thr Gly Ser Leu Gln His Ser Phe Asp
    370                 375                 380
Val Gly Phe Glu Tyr Ser Asn Ile Lys Gln Asp Lys Asp Ser Tyr Thr
385                 390                 395                 400
Gln Thr Ile Ala Lys Gly Ala Met Pro Cys Lys Val Gly Ala Asn Asp
                405                 410                 415
Ala Ser Asn Pro Ala Leu Cys Thr Ser Leu Trp Asp Pro Asp Pro His
            420                 425                 430
Asp Tyr Tyr Pro Gly His Leu Ser Arg Asn Asp Asn Pro Ala Arg Tyr
        435                 440                 445
Ser Thr Asp Thr Ile Ala Leu Tyr Gly Phe Asp Thr Ile Lys Phe Asn
    450                 455                 460
Glu Gln Trp Gln Ala Ser Val Gly Leu Arg Trp Asp Asn Tyr Arg Val
465                 470                 475                 480
Ser Gly Ser Asn Ile Ala Arg Gly Arg Asn Asp Pro Ala Ser Thr Pro
                485                 490                 495
Ala Phe Tyr Ser Thr Ser Arg Glu Asp Asn Leu Phe Asn Tyr Gln Leu
            500                 505                 510
Gly Leu Ala Tyr Lys Pro Val Pro Asn Gly Thr Ile Tyr Ala Ser Tyr
        515                 520                 525
Gly Thr Ser Ser Thr Pro Ser Ala Val Ala Gly Ser Asn Val Ser Asp
    530                 535                 540
Ala Val Thr Val Ser Asn Glu Ser Leu Ala Pro Glu Lys Ser Arg Thr
545                 550                 555                 560
Val Glu Val Gly Thr Lys Trp Gln Leu Phe Asp Asp Arg Leu Thr Leu
                565                 570                 575
Ser Gly Ala Leu Phe Gln Asp Ile Arg Lys Asn Thr Ser Val Ala Val
            580                 585                 590
Ser Ala Thr Glu Thr Glu Gln Ile Gly Lys Ala Lys Val Arg Gly Ile
        595                 600                 605
Glu Leu Gly Phe Ser Gly Ser Ile Thr Pro Lys Trp Asn Val Tyr Gly
    610                 615                 620
Gly Tyr Thr Phe Met Asp Ser Glu Leu Val Glu Gly Ala Tyr Asn Ser
625                 630                 635                 640
Gly Ala Val Gly Gln Asp Leu Pro Asn Thr Pro Arg Asn Ala Phe Ser
                645                 650                 655
Leu Trp Thr Thr Tyr Lys Leu Val Pro Gln Leu Thr Val Gly Gly Gly
            660                 665                 670
Ala Tyr Tyr Val Asp Lys Val Tyr Gly Asn Ala Asp Asn Gly Arg Asn
        675                 680                 685
Ala Asp Gly Thr Pro Lys Ala Arg Trp Val Pro Ser Tyr Trp Arg Phe
    690                 695                 700
Asp Ala Met Ala Ala Tyr Glu Phe Asn Asp His Leu Thr Ala Gln Leu
705                 710                 715                 720
Asn Val Met Asn Ile Phe Asp Lys Thr Tyr Tyr Thr Lys Ala Tyr Ala
                725                 730                 735
Ala His Tyr Ala Ala Leu Gly Thr Gly Arg Ala Ala Val Leu Ser Phe
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          740                 745                 750
Asn Ile Lys Tyr
        755
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<210> 17
<211> 2109
<212> DNA
<213> Bordetella Pertussis

<400> 17

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ctgcccaccg tgcaggtcac cggcaggggc gagaccgcca ccggcccggt cgacggctat 180
gccgccacgc gcagcgccac cgccaccaag accgataccc cgctgtcgga aaccccgcag 240
gccgtcacgg tgatcccgcg cgagcagatc atcgaccagg gcgcgcagaa cgtgcaggac 300
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tacgtgcggg tgcgcggggt ggagccggtc cagtatctcg acggcctgaa gcagttcttc 420

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cgcggcaagc aatgggaagc aggcctgaag tacatgccgc aggacaccgg ctatgaggcc 1620
accctggcgg cctacgacct gcgcgagcgc aaccgccaga ccaacgaccc gtccgatccc 1680
accaaccagg tgcagaccgg caagaccaag acgcgcggca tcgaactgga attccgcggc 1740
cgcgtcacgc cgcagatgga tgtgatcgcc aactacaact acaccgacat cgacccgcag 1800
ctcgaaggcc tgcccaagca cacgttctcg ctgtggagca aataccggtt cagcgtgggc 1860
gatgtgcatg gctttgccgc cggcgccggc gtgcgctacc tgaacgcgtt tcgcgacggg 1920
tccgcgcccg agaccggctc ggtggccctg ttcgacgcca tgctcagcta cgacaccggt 1980
tcgtggcgct atgcgctgaa cgtcgccaac atcgccgaca agacctacga ggtggtgtgc 2040
ctgcggcgcg gcgattgctt ctacggccag cgccgcacgg tcaccctgag cgccatgtac 2100
cgcttctag                                                          2109
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<210> 18
<211> 702
<212> PRT
<213> Bordetella Pertussis

<400> 18

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Leu His Thr Arg Thr Pro Gln Arg Gln Arg Pro Val Ala Pro Arg Leu
 1               5                  10                  15
Leu His Leu Ser Leu Ala Ala Ser Leu Ala Ala Gly Ala Ala Gln Ala
            20                  25                  30
Gln Thr Ala Thr Glu Ala Thr Thr Leu Pro Thr Val Gln Val Thr Gly
        35                  40                  45
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Arg Gly Glu Thr Ala Thr Gly Pro Val Asp Gly Tyr Ala Ala Thr Arg
    50                  55                  60
Ser Ala Thr Ala Thr Lys Thr Asp Thr Pro Leu Ser Glu Thr Pro Gln
65                  70                  75                  80
Ala Val Thr Val Ile Pro Arg Glu Gln Ile Ile Asp Gln Gly Ala Gln
                85                  90                  95
Asn Val Gln Asp Thr Met Asn Tyr Ala Ala Gly Val Arg Pro Asn Ala
            100                 105                 110
Tyr Gly Val Asp Asn Arg Gly Asp Tyr Val Arg Val Arg Gly Val Glu
        115                 120                 125
Pro Val Gln Tyr Leu Asp Gly Leu Lys Gln Phe Phe Asn Tyr Asn Asn
    130                 135                 140
Pro Arg Thr Glu Val Tyr Gly Leu Glu Arg Val Glu Val Leu Arg Gly
145                 150                 155                 160
Pro Ala Ser Met Leu Tyr Gly Gln Gly Ser Thr Gly Gly Val Val Asn
                165                 170                 175
Leu Val Ser Lys Arg Pro Gln Pro Glu Ala Met Arg Glu Ile Gly Val
            180                 185                 190
Thr Val Gly Asn His Asn Arg Lys Glu Ile Gln Ala Asp Leu Thr Gly
        195                 200                 205
Pro Leu Thr Glu Asp Gly Thr Trp Leu Tyr Gln Val Val Ala Leu Gly
    210                 215                 220
Arg Asp Ser Asp Thr Gln Val Gln Tyr Thr Lys Asp Asp Arg Met Met
225                 230                 235                 240
Leu Ala Pro Ser Leu Thr Trp Gln Pro Ser Ala Ala Thr Ser Leu Thr
                245                 250                 255
Leu Gln Ala Tyr Trp Gln Lys Asp Lys Ser Gly Thr Thr Gln Ala Phe
            260                 265                 270
Leu Pro Trp Ser Gly Thr Val Ser Gly Asn Pro Asn Gly Arg Ile Pro
        275                 280                 285
Thr Arg Arg Phe Thr Ser Glu Pro Gly Phe Asp Arg Tyr Asp Thr Glu
    290                 295                 300
Gln Phe Ser Val Gly Trp Gln Phe Glu His Lys Phe Asn Asp Asn Trp
305                 310                 315                 320
Lys Val Arg Gln Asn Leu Arg His Thr Ser Ser Lys Val Asp Tyr Ser
                325                 330                 335
Thr Leu Tyr Pro Ala Val Tyr Gly Asn Pro Asp Asn Pro Phe Ile Asp
            340                 345                 350
Ala Asp Gln Arg Val Val Asn Arg Tyr Leu Tyr Ile Lys Asn Pro Arg
        355                 360                 365
Met Arg Ser Leu Leu Ala Asp Gln Asn Leu Glu Gly Lys Val Asn Trp
    370                 375                 380
Gly Arg Ala Glu His Thr Leu Leu Met Gly Val Asp Tyr Ser Arg Tyr
385                 390                 395                 400
Arg Glu Thr Gly Glu Thr Gly Ser Gly Phe Gly Ala Pro Leu Asp Leu
                405                 410                 415
Tyr Gln Pro Val Tyr Gly Thr Leu Pro Asp Tyr Ala Met Ser Asp Val
            420                 425                 430
Pro Lys Asn Lys Gln Gln Gln Ile Gly Val Tyr Leu Gln Asp Gln Ile
        435                 440                 445
Lys Phe Asp Arg Asn Trp Ile Val Val Ala Gly Leu Arg His Asp Arg
    450                 455                 460
Val Ala Asn Ser Val Glu Gly Ala Asp Lys Glu Thr Asp Asn Ala Thr
465                 470                 475                 480
Thr Lys Arg Leu Gly Leu Met Tyr Ala Ala Asp Asn Gly Trp Ser Pro
                485                 490                 495
Tyr Leu Ser Tyr Ser Glu Ser Phe Thr Pro Ile Ala Gly Thr Asp Asn
            500                 505                 510
Ser Gly Asn Arg Trp Val Pro Met Arg Gly Lys Gln Trp Glu Ala Gly
        515                 520                 525
Leu Lys Tyr Met Pro Gln Asp Thr Gly Tyr Glu Ala Thr Leu Ala Ala
```

```
    530                 535                 540
Tyr Asp Leu Arg Glu Arg Asn Arg Gln Thr Asn Asp Pro Ser Asp Pro
545                 550                 555                 560
Thr Asn Gln Val Gln Thr Gly Lys Thr Lys Thr Arg Gly Ile Glu Leu
                565                 570                 575
Glu Phe Arg Gly Arg Val Thr Pro Gln Met Asp Val Ile Ala Asn Tyr
            580                 585                 590
Asn Tyr Thr Asp Ile Asp Pro Gln Leu Glu Gly Leu Pro Lys His Thr
        595                 600                 605
Phe Ser Leu Trp Ser Lys Tyr Arg Phe Ser Val Gly Asp Val His Gly
    610                 615                 620
Phe Ala Ala Gly Ala Gly Val Arg Tyr Leu Asn Ala Phe Arg Asp Gly
625                 630                 635                 640
Ser Ala Pro Glu Thr Gly Ser Val Ala Leu Phe Asp Ala Met Leu Ser
                645                 650                 655
Tyr Asp Thr Gly Ser Trp Arg Tyr Ala Leu Asn Val Ala Asn Ile Ala
            660                 665                 670
Asp Lys Thr Tyr Glu Val Val Cys Leu Arg Arg Gly Asp Cys Phe Tyr
        675                 680                 685
Gly Gln Arg Arg Thr Val Thr Leu Ser Ala Met Tyr Arg Phe
    690                 695                 700
```

<210> 19
<211> 2613
<212> DNA
<213> Bordetella pertussis

<400> 19

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atggtttacg cttgcgatca gggcgcccgc cgcgcccgtc ccgcgccgcc aaggcgcccc 60
caaacggcac tggccatgcg cggcgcgctg gcggcatgcg cactggccgg tacgctggcg 120
gccgctcccg ccgccgcgca gccgacggcg gcgcccgcat cggcgggcgc gcgcgcctgg 180
cacatcgacg ccggcccccc gggcgaggcc ctggcgcgct ttgccgacca ggccggcatt 240
accctgctgt acgaccccgc cgcggtgcgc ggccgcgcca gcgccggcct gcaaggcgtg 300
tactcggtgc ccgacggcct ggcgcgcctg ctcgatggca gcggcctgga cgcgcgccag 360
cgcggcgccg gcacctacgt gctgcaggcg ctgcccgccg gcccggtcgc ccagctggcg 420
ccggtcacca tcgaggctga cggcgtgcgc gccgatcccg cctgggcccg caccgccacg 480
cgccgcgagc tcgacgcgcg ccaggtgctc gactggagcg atatcggcaa gcgcgtcgat 540
cccggcgtca actacaaccg ccgcaccaag agcatcaaca tccgcggcct ggacgaaaac 600
cgcgtggtca cgcgcatcga cggcatccgc ctgccctggc tcgacgacgg cgcgcgcggc 660
atccagggcg ggctgaacgc ggtggacttc aacaccctgt cgcgcctgga cgtcgtgcgc 720
ggcgccgact ccagcgcggc cggctccggc gcgctgggcg gcctggccga cctgcgcacg 780
ctcgaacccg ccgacctgct gcgcgacggg cgccgcttcg gcgcgctggc caagtccgac 840
tatgactcgg ccgacgccag ctggggcctg aacgcggccc tggccgggca ggtccacgac 900
gacaccagct ggctgttgca ggcgggcacc cgcaatgggc acgacctgga caaccgcgcc 960
gacacgggcg gctacggcag caagcgcagc cagcccagcc ccgaggacta cgcccagaac 1020
aacttcctgc tcaagctgca gcagcgcatc gacggcggcc atcgcctcgg cctgacgggc 1080
gaatacttca agcgccgcgc cgacctcgac cagatgtacc agcagggcgc cggcaccagc 1140
taccagtacg gcgccaaccg cacccacgag gaaaccacgc gcaagcgcgt ctcgctggac 1200
taccagtaca acgccccgca ggccggcgcc gcgatcgaca gcgcccgggc catggtgtat 1260
tggcagcggc tgcggctgga cagctcgcag gacgcccgcc gcacgcgcga cgggcgcgcc 1320
tacgcccgcc ccggcgaccc gtacttctac ggctacccca gcggccccta cgggcgcagc 1380
aactcgatcc aggaatcgat cctcggcgtc aacggcgagc tctccagccg cttcgaaggc 1440
atggtgtcgc agcgcgtgac gataggcggc gaatggtacg gcaaccgcac cgagcagtac 1500
tcggacggct acgacaactg ccccgccatc ccgcccggca cgcccgcgcc gatggggccg 1560
cgcctgtgcg acatgctgca taccaaccag gccgacatgc cccgggtcaa gggcagccag 1620
tgggccatct gggcgcagga cgaaatcgcc ttcgccgacg ggcgctacat cctgaccccg 1680
tcactgcgct acgaccatta cgagcagaag ccgcagcaag gcggcggcta ccagaacaac 1740
cccaacgccg gcgcgctgcc gccgtcgtcg tcgggggggcc gcttctcgcc caagctgctg 1800
ggcacctgga aggcgcgcga ggcgctgacg ctgtatgcgc aatacggctt cggctaccgg 1860
gcgccgtcgg ccaccgagct gtacaccaac tacggcggcc cgggaaccta tctgcgcgtg 1920
```

```
ggcaatccct ccttgaagcc cgagaccagc aagggctggg aactgggcgc ccgcctgggc 1980
gacgaccagt tgggaggcgc cgtatcgctg ttcgacaacc gctaccagaa cttcatcgac 2040
aagaacgtgc cgctgggcaa gggttcgccg caatggcagc cggcctggga cggccagtac 2100
ccgctgggcg tcaccgggct ggccaaccgg gcgcgcgtgc gcatctatgg cgccgaagcc 2160
tcggcgcact ggcggttcgc gcccaactgg cgcacctggg gctcgctggc ctgggccgtg 2220
ggcaaggacg aaaacaccgg ccagcacctg aattcggtgc cgccgctcaa ggccatcctc 2280
ggcctgggct accagcgcga cgaatggggc atcgacgcca tgctgacggc cgccacgcgc 2340
cgcgacgacg tgcaataccc cgaggcctcc gccagcgcgc gctacgccga tttccaggcc 2400
ccgggctacg gcgtggtgga tctgtccgcc tactggcgcc cggccgccgt caagggcctg 2460
cagctgcagg cgggcgtgtt caacctgttc gacaagaaat actgggaagc catcaacgtg 2520
cccacggcgg gtgccattgc gattccgcga ccgttagact ggtacaacga gccaggccgc 2580
agcgtgcgcg tatcgttgac ctaccagtat tga                              2613

<210> 20
<211> 870
<212> PRT
<213> Bordetella pertussis

<400> 20
Met Val Tyr Ala Cys Asp Gln Gly Ala Arg Arg Ala Arg Pro Ala Pro
 1               5                  10                  15
Pro Arg Arg Pro Gln Thr Ala Leu Ala Met Arg Gly Ala Leu Ala Ala
            20                  25                  30
Cys Ala Leu Ala Gly Thr Leu Ala Ala Ala Pro Ala Ala Ala Gln Pro
        35                  40                  45
Thr Ala Ala Pro Ala Ser Ala Gly Ala Arg Ala Trp His Ile Asp Ala
    50                  55                  60
Gly Pro Leu Gly Glu Ala Leu Ala Arg Phe Ala Asp Gln Ala Gly Ile
65                  70                  75                  80
Thr Leu Leu Tyr Asp Pro Ala Ala Val Arg Gly Arg Ala Ser Ala Gly
                85                  90                  95
Leu Gln Gly Val Tyr Ser Val Pro Asp Gly Leu Ala Arg Leu Leu Asp
            100                 105                 110
Gly Ser Gly Leu Asp Ala Arg Gln Arg Gly Ala Gly Thr Tyr Val Leu
        115                 120                 125
Gln Ala Leu Pro Ala Gly Pro Val Ala Gln Leu Ala Pro Val Thr Ile
    130                 135                 140
Glu Ala Asp Gly Val Arg Ala Asp Pro Ala Trp Ala Arg Thr Ala Thr
145                 150                 155                 160
Arg Arg Glu Leu Asp Ala Arg Gln Val Leu Asp Trp Ser Asp Ile Gly
                165                 170                 175
Lys Arg Val Asp Pro Gly Val Asn Tyr Asn Arg Arg Thr Lys Ser Ile
            180                 185                 190
Asn Ile Arg Gly Leu Asp Glu Asn Arg Val Val Thr Arg Ile Asp Gly
        195                 200                 205
Ile Arg Leu Pro Trp Leu Asp Asp Gly Ala Arg Gly Ile Gln Gly Gly
    210                 215                 220
Leu Asn Ala Val Asp Phe Asn Thr Leu Ser Arg Leu Asp Val Val Arg
225                 230                 235                 240
Gly Ala Asp Ser Ser Ala Ala Gly Ser Gly Ala Leu Gly Gly Leu Ala
                245                 250                 255
Asp Leu Arg Thr Leu Glu Pro Ala Asp Leu Leu Arg Asp Gly Arg Arg
            260                 265                 270
Phe Gly Ala Leu Ala Lys Ser Asp Tyr Asp Ser Ala Asp Ala Ser Trp
        275                 280                 285
Gly Leu Asn Ala Ala Leu Ala Gly Gln Val His Asp Asp Thr Ser Trp
    290                 295                 300
Leu Leu Gln Ala Gly Thr Arg Asn Gly His Asp Leu Asp Asn Arg Ala
305                 310                 315                 320
Asp Thr Gly Gly Tyr Gly Ser Lys Arg Ser Gln Pro Ser Pro Glu Asp
                325                 330                 335
```

Tyr Ala Gln Asn Asn Phe Leu Leu Lys Leu Gln Gln Arg Ile Asp Gly
340 345 350
Gly His Arg Leu Gly Leu Thr Gly Glu Tyr Phe Lys Arg Arg Ala Asp
355 360 365
Leu Asp Gln Met Tyr Gln Gln Gly Ala Gly Thr Ser Tyr Gln Tyr Gly
370 375 380
Ala Asn Arg Thr His Glu Glu Thr Thr Arg Lys Arg Val Ser Leu Asp
385 390 395 400
Tyr Gln Tyr Asn Ala Pro Gln Ala Gly Ala Ala Ile Asp Ser Ala Arg
405 410 415
Ala Met Val Tyr Trp Gln Arg Leu Arg Leu Asp Ser Ser Gln Asp Ala
420 425 430
Arg Arg Thr Arg Asp Gly Arg Ala Tyr Ala Arg Pro Gly Asp Pro Tyr
435 440 445
Phe Tyr Gly Tyr Pro Ser Gly Pro Tyr Gly Arg Ser Asn Ser Ile Gln
450 455 460
Glu Ser Ile Leu Gly Val Asn Gly Glu Leu Ser Ser Arg Phe Glu Gly
465 470 475 480
Met Val Ser Gln Arg Val Thr Ile Gly Gly Glu Trp Tyr Gly Asn Arg
485 490 495
Thr Glu Gln Tyr Ser Asp Gly Tyr Asp Asn Cys Pro Ala Ile Pro Pro
500 505 510
Gly Thr Pro Ala Pro Met Gly Pro Arg Leu Cys Asp Met Leu His Thr
515 520 525
Asn Gln Ala Asp Met Pro Arg Val Lys Gly Ser Gln Trp Ala Ile Trp
530 535 540
Ala Gln Asp Glu Ile Ala Phe Ala Asp Gly Arg Tyr Ile Leu Thr Pro
545 550 555 560
Ser Leu Arg Tyr Asp His Tyr Glu Gln Lys Pro Gln Gln Gly Gly Gly
565 570 575
Tyr Gln Asn Asn Pro Asn Ala Gly Ala Leu Pro Pro Ser Ser Ser Gly
580 585 590
Gly Arg Phe Ser Pro Lys Leu Leu Gly Thr Trp Lys Ala Arg Glu Ala
595 600 605
Leu Thr Leu Tyr Ala Gln Tyr Gly Phe Gly Tyr Arg Ala Pro Ser Ala
610 615 620
Thr Glu Leu Tyr Thr Asn Tyr Gly Gly Pro Gly Thr Tyr Leu Arg Val
625 630 635 640
Gly Asn Pro Ser Leu Lys Pro Glu Thr Ser Lys Gly Trp Glu Leu Gly
645 650 655
Ala Arg Leu Gly Asp Asp Gln Leu Gly Gly Ala Val Ser Leu Phe Asp
660 665 670
Asn Arg Tyr Gln Asn Phe Ile Asp Lys Asn Val Pro Leu Gly Lys Gly
675 680 685
Ser Pro Gln Trp Gln Pro Ala Trp Asp Gly Gln Tyr Pro Leu Gly Val
690 695 700
Thr Gly Leu Ala Asn Arg Ala Arg Val Arg Ile Tyr Gly Ala Glu Ala
705 710 715 720
Ser Ala His Trp Arg Phe Ala Pro Asn Trp Arg Thr Trp Gly Ser Leu
725 730 735
Ala Trp Ala Val Gly Lys Asp Glu Asn Thr Gly Gln His Leu Asn Ser
740 745 750
Val Pro Pro Leu Lys Ala Ile Leu Gly Leu Gly Tyr Gln Arg Asp Glu
755 760 765
Trp Gly Ile Asp Ala Met Leu Thr Ala Ala Thr Arg Arg Asp Asp Val
770 775 780
Gln Tyr Pro Glu Ala Ser Ala Ser Ala Arg Tyr Ala Asp Phe Gln Ala
785 790 795 800
Pro Gly Tyr Gly Val Val Asp Leu Ser Ala Tyr Trp Arg Pro Ala Ala
805 810 815
Val Lys Gly Leu Gln Leu Gln Ala Gly Val Phe Asn Leu Phe Asp Lys

```
            820                 825                 830
Lys Tyr Trp Glu Ala Ile Asn Val Pro Thr Ala Gly Ala Ile Ala Ile
        835                 840                 845
Pro Arg Pro Leu Asp Trp Tyr Asn Glu Pro Gly Arg Ser Val Arg Val
    850                 855                 860
Ser Leu Thr Tyr Gln Tyr
865                 870
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<210> 21
<211> 2283
<212> DNA
<213> Bordetella pertussis

<400> 21

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ttgcggccgg gccggcggcg cgccgcgcgc tgcccgtcat cgacatgccc gccggctgcc 60
ggcgcggcgc cacaacgtgt gatcatgaaa cagacttccc tttactacgc caccctgggc 120
ctggtcggac tggcgctggc cgcgcccgcg cgcgcgcagg agcaatcgct tcccgtccaa 180
ctcgcgccgg tggtcgtgca tggcgcgccc gaggccaacg gcccgctgaa tctcgacgcg 240

gtcgacagca ccggcagccg cctgggcctg accctgcgcg agacgcccgc ctcggtgacc 300
gtcatcaacc gcgagcagat cgaggcgcgc ggcgcgctcg acacgcagga aatcgcccgc 360
ggcatcgtcg gcgtggacaa tgcctcgccg cccggctcgg ccggctcggt gagctaccgc 420
ggtttctcgg gttcgcaggt cagccagttg ttcaacggca tttcggtgca gtacgacgtg 480
gtcgccgcgc gtccgatcga cagctggatc tacgaccgcg tcgaagccat cggcgggccg 540
tccagcttcc tgttcggcgc gggcgcggtg ggcggcgcca tcaactacgt gaccaaggtg 600
gcgcagcgcg atacgttcta cgacggccag ctgcgcctgg gttcgtacgg cgcgcgccag 660
gcatccgtgg gccttaaccg gcaattggcc ggcgagccgg gcgggcgcgg ccagtacctg 720
cgcatcgacg ccaacgccaa cgcgagcgac ggctgggtcg acggcaatcg ctcgcacgcc 780
gagcaggtgg cggcctcgct gctgtcggac ctgggcgaac gcgtgaccca tacgctggcg 840
ctggagtacc agcacgagat ggtgcaccgg ccttactggg gtacgccgct gaccaccgac 900
ggcgacggcg tggtgcgcgg cgaaggccac atccgcggcg ggacgcgctg gaagaactac 960
aacgtcgacg acggccggta cgagcaatcg gtgtggtggc tgcgttcgct gaccgaatgg 1020
caggccagcg accgcctgag tttccgcaat acgctgtact actatcgcgc cgatcgcgat 1080
ttccagaacc tcgagaccta ccgctacaac ccgggcaaca gccaggtgct gcgctccggc 1140
gcgctgctgc agcgccacga gcagcgcctg ctgggcaacc gcatcgaagg cctgtaccac 1200
ggcagcctgg gcggcctgcg cagcgactgg tcgttcggcg ccgactacag cgtcaaccgc 1260
cagacgcgct accccaccag cgtggccggg caagtcgata gcgtggaccc gtacgagttc 1320
gacccgggcg agttctacga cattccgggc atgcggcgcg gccacgtgcc cgaccgcgac 1380
aacaaggtgc gcacgctggc cttcatgctg gaaaaccgca ccgaagtggg cggcggggtc 1440
gcgctggtga cggctctgcg gcacgacatc atcgacctgg acctgaccaa ccggcgcgcg 1500
gccagcgcgg cttcgcccgg gcacgcctcg cgccgctaca acccgaccac ggggcgcgtc 1560
gccgtcaatt gggaggtcag tcccggcgcg accctgtacg cgcaatacgc caccgccgcc 1620
gacccgcctt ccggcgtact gtcgaccgcg accttcgccg atgtgctgaa caacgacaag 1680
ctgaccaccg gcacccaggt cgaggccggc ggcaagttcg cgttctggga cggccgcggc 1740
acggcgaccg tggcggtcta cgagatcaag cgcaagaacc tcgccacgcc cgatcccctc 1800
aaccccggca gcagcctgcc ggtgggcagc cagtctgccc gcgggctgga gctggccggc 1860
ggattgcagt tgacgcgcgc cttgtcgctg caggccaacc tggcgctggt cgacccccgc 1920
tatgacgatt tctcgcagaa cgtcggcggg gtggcggtct cgcgcaacgg caaggtgccg 1980
gtcaacacgc cgcgccggct ggccaacgtg tggctggact acgccttcgc gcccgactgg 2040
cgcgccagcc tggcggcgcg ccacgtgggc aagacctatg cggacgcggc caatacggtg 2100
tgggcgccgg cctataccgt gttcgacgcg gcgctgtcgc atcgcatcga ccgccatttc 2160
agcgtgacgg cgcgggtgcg caacctgacc gacaaggtct atgccgccag cgtgaccggc 2220
gcgcccatgt attacctggg cgcgccgcgc agcgtcgaac tcgcgctgca ggcgcgcttc 2280
tga                                                                2283
```

<210> 22
<211> 760
<212> PRT
<213> Bordetella pertussis

<400> 22
Leu Arg Pro Gly Arg Arg Arg Ala Ala Arg Cys Pro Ser Ser Thr Cys
1 5 10 15
Pro Pro Ala Ala Gly Ala Ala Pro Gln Arg Val Ile Met Lys Gln Thr
20 25 30
Ser Leu Tyr Tyr Ala Thr Leu Gly Leu Val Gly Leu Ala Leu Ala Ala
35 40 45
Pro Ala Arg Ala Gln Glu Gln Ser Leu Pro Val Gln Leu Ala Pro Val
50 55 60
Val Val His Gly Ala Pro Glu Ala Asn Gly Pro Leu Asn Leu Asp Ala
65 70 75 80
Val Asp Ser Thr Gly Ser Arg Leu Gly Leu Thr Leu Arg Glu Thr Pro
85 90 95
Ala Ser Val Thr Val Ile Asn Arg Glu Gln Ile Glu Ala Arg Gly Ala
100 105 110
Leu Asp Thr Gln Glu Ile Ala Arg Gly Ile Val Gly Val Asp Asn Ala
115 120 125
Ser Pro Pro Gly Ser Ala Gly Ser Val Ser Tyr Arg Gly Phe Ser Gly
130 135 140
Ser Gln Val Ser Gln Leu Phe Asn Gly Ile Ser Val Gln Tyr Asp Val
145 150 155 160
Val Ala Ala Arg Pro Ile Asp Ser Trp Ile Tyr Asp Arg Val Glu Ala
165 170 175
Ile Gly Gly Pro Ser Ser Phe Leu Phe Gly Ala Gly Ala Val Gly Gly
180 185 190
Ala Ile Asn Tyr Val Thr Lys Val Ala Gln Arg Asp Thr Phe Tyr Asp
195 200 205
Gly Gln Leu Arg Leu Gly Ser Tyr Gly Ala Arg Gln Ala Ser Val Gly
210 215 220
Leu Asn Arg Gln Leu Ala Gly Glu Pro Gly Gly Arg Gly Gln Tyr Leu
225 230 235 240
Arg Ile Asp Ala Asn Ala Asn Ala Ser Asp Gly Trp Val Asp Gly Asn
245 250 255
Arg Ser His Ala Glu Gln Val Ala Ala Ser Leu Leu Ser Asp Leu Gly
260 265 270
Glu Arg Val Thr His Thr Leu Ala Leu Glu Tyr Gln His Glu Met Val
275 280 285
His Arg Pro Tyr Trp Gly Thr Pro Leu Thr Thr Asp Gly Asp Gly Val
290 295 300
Val Arg Gly Glu Gly His Ile Arg Gly Gly Thr Arg Trp Lys Asn Tyr
305 310 315 320
Asn Val Asp Asp Gly Arg Tyr Glu Gln Ser Val Trp Trp Leu Arg Ser
325 330 335
Leu Thr Glu Trp Gln Ala Ser Asp Arg Leu Ser Phe Arg Asn Thr Leu
340 345 350
Tyr Tyr Tyr Arg Ala Asp Arg Asp Phe Gln Asn Leu Glu Thr Tyr Arg
355 360 365
Tyr Asn Pro Gly Asn Ser Gln Val Leu Arg Ser Gly Ala Leu Leu Gln
370 375 380
Arg His Glu Gln Arg Leu Leu Gly Asn Arg Ile Glu Gly Leu Tyr His
385 390 395 400
Gly Ser Leu Gly Gly Leu Arg Ser Asp Trp Ser Phe Gly Ala Asp Tyr
405 410 415
Ser Val Asn Arg Gln Thr Arg Tyr Pro Thr Ser Val Ala Gly Gln Val
420 425 430
Asp Ser Val Asp Pro Tyr Glu Phe Asp Pro Gly Glu Phe Tyr Asp Ile
435 440 445
Pro Gly Met Arg Arg Gly His Val Pro Asp Arg Asp Asn Lys Val Arg
450 455 460
Thr Leu Ala Phe Met Leu Glu Asn Arg Thr Glu Val Gly Gly Gly Val
465 470 475 480

```
Ala Leu Val Thr Ala Leu Arg His Asp Ile Ile Asp Leu Asp Leu Thr
                485                 490                 495
Asn Arg Arg Ala Ala Ser Ala Ala Ser Pro Gly His Ala Ser Arg Arg
            500                 505                 510
Tyr Asn Pro Thr Thr Gly Arg Val Ala Val Asn Trp Glu Val Ser Pro
        515                 520                 525
Gly Ala Thr Leu Tyr Ala Gln Tyr Ala Thr Ala Ala Asp Pro Pro Ser
    530                 535                 540
Gly Val Leu Ser Thr Ala Thr Phe Ala Asp Val Leu Asn Asn Asp Lys
545                 550                 555                 560
Leu Thr Thr Gly Thr Gln Val Glu Ala Gly Gly Lys Phe Ala Phe Trp
                565                 570                 575
Asp Gly Arg Gly Thr Ala Thr Val Ala Val Tyr Glu Ile Lys Arg Lys
            580                 585                 590
Asn Leu Ala Thr Pro Asp Pro Leu Asn Pro Gly Ser Ser Leu Pro Val
        595                 600                 605
Gly Ser Gln Ser Ala Arg Gly Leu Glu Leu Ala Gly Gly Leu Gln Leu
    610                 615                 620
Thr Arg Ala Leu Ser Leu Gln Ala Asn Leu Ala Leu Val Asp Pro Arg
625                 630                 635                 640
Tyr Asp Asp Phe Ser Gln Asn Val Gly Gly Val Ala Val Ser Arg Asn
                645                 650                 655
Gly Lys Val Pro Val Asn Thr Pro Arg Arg Leu Ala Asn Val Trp Leu
            660                 665                 670
Asp Tyr Ala Phe Ala Pro Asp Trp Arg Ala Ser Leu Ala Ala Arg His
        675                 680                 685
Val Gly Lys Thr Tyr Ala Asp Ala Ala Asn Thr Val Trp Ala Pro Ala
    690                 695                 700
Tyr Thr Val Phe Asp Ala Ala Leu Ser His Arg Ile Asp Arg His Phe
705                 710                 715                 720
Ser Val Thr Ala Arg Val Arg Asn Leu Thr Asp Lys Val Tyr Ala Ala
                725                 730                 735
Ser Val Thr Gly Ala Pro Met Tyr Tyr Leu Gly Ala Pro Arg Ser Val
            740                 745                 750
Glu Leu Ala Leu Gln Ala Arg Phe
        755                 760
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<210> 23
<211> 1890
<212> DNA
<213> Bordetella pertussis

<400> 23
atgaaatccc gctcactccg gcgctgcgcc ggtgtcctgg cctgtgtcgc tccgttggcc 60
ggccacgccc aggccggcgc cgccgccggc caacccatcc ccgaactcga tccggtcgtc 120
gtcaccgccg cgcgatcgcc ccagctgctc aagaatgtgc tggccgacgc cagcgtgatc 180
gagcgcgata cgctggcgcg cgccggccag tccagcctgg ccgaagtgct ggcgcagcag 240
cacggcatcg aattcgccga cagcggcggc ccgcaaagcg tcaccagcct gttcatgcgc 300
ggcgccaaca gcaaccagac cctggtcctg ctcaacggcc agcgcatcaa caacgccaac 360
ggcggcggca ttgcgctcaa cgcgctgccg ccggaagcca tcgaacgcat cgagatcatg 420
cgtggcgcgg ccagcagcct gtacggggcc gacgcgatcg gcggcgtgat caacatcatt 480
acccgcgagc cgggcgacaa ggcgctgtcg gcctatgcca acgccggtta cggcacctac 540
ggcaccagcc gctacgacgc cggcgtctcg ggcgcggccg acggcttcag ctacagcctg 600
tccaccggct atggccagag ccatggcttc aacgccacca accgccgctc gttctcgtac 660
aacccggaca aggacagcta ctaccagaac tacgccaccg gcacgctggg ctacgaatgg 720
cggcccgagc agaaagtggt ggcgcaggtc taccgcagcc gcatcaacgg cggctacgac 780
gcctcggcct cgtacgacta caacgaccgc tacatccagg acctgcaggc ctattcgctg 840
gccagcgaaa accgcctgac ccgctactgg aagagcacgc tgcgcgccgg ctatgtggaa 900
gacaagaacg attcgcgcgc cgaaggcatg ttcgaagaca acaacacgcg cttccggacc 960
cgccagatgc agtacctgtg gcagaacgac ttcaccctgg ccgccggcca gacgctgacg 1020

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ctggcctacg agcacctgga ccagcgcgcc gacggccaga tgagcaccgc caccggcatc 1080
ggcaactaca ccgagacgcg ccgccacgtg aactcgtaca ccggcgtcta cctgggcgat 1140
ttcggccgcc accatgtgca ggccagcctg cgcaacgaca acaactcgca gttcggcagc 1200
cacaccaccg gcggcctggc ctacgggttc gacctgacgc ccaacctgcg cgccaccgtg 1260
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ctgaaatacc aggacgagga cagcgaactg ggcgtggtgt attaccagac ccgcatcaag 1440
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caaggcttca ccatcagcgg cgcgcaccgc ttcggcaaca cgcgcctgcg cgccagcctg 1560
gacctgagca acccgcgcaa cgaagacacc ggcaagcaat tgctgcgccg cgcccgcacg 1620
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gcctcggacg agcgctacga ctacggcttc cccgaggaaa agcgcctggg cggctacggc 1740
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aacaacgtgc tcggccagcg ctacaccttg gccgacggct acaacacggc cggctcgaac 1860
gccttcgtca acccgtcgtg gcgcatgtag                                  1890

<210> 24
<211> 629
<212> PRT
<213> Bordetella pertussis

<400> 24
Met Lys Ser Arg Ser Leu Arg Arg Cys Ala Gly Val Leu Ala Cys Val
 1               5                  10                  15
Ala Pro Leu Ala Gly His Ala Gln Ala Gly Ala Ala Ala Gly Gln Pro
            20                  25                  30
Ile Pro Glu Leu Asp Pro Val Val Val Thr Ala Ala Arg Ser Pro Gln
        35                  40                  45
Leu Leu Lys Asn Val Leu Ala Asp Ala Ser Val Ile Glu Arg Asp Thr
    50                  55                  60
Leu Ala Arg Ala Gly Gln Ser Ser Leu Ala Glu Val Leu Ala Gln Gln
65                  70                  75                  80
His Gly Ile Glu Phe Ala Asp Ser Gly Gly Pro Gln Ser Val Thr Ser
                85                  90                  95
Leu Phe Met Arg Gly Ala Asn Ser Asn Gln Thr Leu Val Leu Leu Asn
            100                 105                 110
Gly Gln Arg Ile Asn Asn Ala Asn Gly Gly Gly Ile Ala Leu Asn Ala
        115                 120                 125
Leu Pro Pro Glu Ala Ile Glu Arg Ile Glu Ile Met Arg Gly Ala Ala
    130                 135                 140
Ser Ser Leu Tyr Gly Ala Asp Ala Ile Gly Gly Val Ile Asn Ile Ile
145                 150                 155                 160
Thr Arg Glu Pro Gly Asp Lys Ala Leu Ser Ala Tyr Ala Asn Ala Gly
                165                 170                 175
Tyr Gly Thr Tyr Gly Thr Ser Arg Tyr Asp Ala Gly Val Ser Gly Ala
            180                 185                 190
Ala Asp Gly Phe Ser Tyr Ser Leu Ser Thr Gly Tyr Gly Gln Ser His
        195                 200                 205
Gly Phe Asn Ala Thr Asn Arg Arg Ser Phe Ser Tyr Asn Pro Asp Lys
    210                 215                 220
Asp Ser Tyr Tyr Gln Asn Tyr Ala Thr Gly Thr Leu Gly Tyr Glu Trp
225                 230                 235                 240
Arg Pro Glu Gln Lys Val Val Ala Gln Val Tyr Arg Ser Arg Ile Asn
                245                 250                 255
Gly Gly Tyr Asp Ala Ser Ala Ser Tyr Asp Tyr Asn Asp Arg Tyr Ile
            260                 265                 270
Gln Asp Leu Gln Ala Tyr Ser Leu Ala Ser Glu Asn Arg Leu Thr Arg
        275                 280                 285
Tyr Trp Lys Ser Thr Leu Arg Ala Gly Tyr Val Glu Asp Lys Asn Asp
    290                 295                 300
Ser Arg Ala Glu Gly Met Phe Glu Asp Asn Asn Thr Arg Phe Arg Thr
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305 310 315 320
Arg Gln Met Gln Tyr Leu Trp Gln Asn Asp Phe Thr Leu Ala Ala Gly
325 330 335
Gln Thr Leu Thr Leu Ala Tyr Glu His Leu Asp Gln Arg Ala Asp Gly
340 345 350
Gln Met Ser Thr Ala Thr Gly Ile Gly Asn Tyr Thr Glu Thr Arg Arg
355 360 365
His Val Asn Ser Tyr Thr Gly Val Tyr Leu Gly Asp Phe Gly Arg His
370 375 380
His Val Gln Ala Ser Leu Arg Asn Asp Asn Asn Ser Gln Phe Gly Ser
385 390 395 400
His Thr Thr Gly Gly Leu Ala Tyr Gly Phe Asp Leu Thr Pro Asn Leu
405 410 415
Arg Ala Thr Val Ala Ala Asn Thr Gly Phe Arg Ala Pro Ser Phe Asn
420 425 430
Asp Leu Tyr Thr Pro Thr Ser Ala Phe Gly Tyr Arg Gly Asn Pro Asp
435 440 445
Leu Lys Pro Glu Glu Ser Arg Asn Ala Glu Ile Gly Leu Lys Tyr Gln
450 455 460
Asp Glu Asp Ser Glu Leu Gly Val Val Tyr Tyr Gln Thr Arg Ile Lys
465 470 475 480
Asn Leu Ile Gln Val Thr Glu Asp Phe Ser Thr Val Glu Asn Val Gly
485 490 495
Arg Ala Arg Leu Gln Gly Phe Thr Ile Ser Gly Ala His Arg Phe Gly
500 505 510
Asn Thr Arg Leu Arg Ala Ser Leu Asp Leu Ser Asn Pro Arg Asn Glu
515 520 525
Asp Thr Gly Lys Gln Leu Leu Arg Arg Ala Arg Thr Val Leu Arg Ala
530 535 540
Gly Ile Asp His Arg Phe Asp Arg Leu Leu Val Gly Ala Glu Trp Tyr
545 550 555 560
Ala Ser Asp Glu Arg Tyr Asp Tyr Gly Phe Pro Glu Glu Lys Arg Leu
565 570 575
Gly Gly Tyr Gly Leu Val Asn Leu Thr Ala Ala Tyr Asp Leu Ser Arg
580 585 590
Asn Met Gln Val Gln Val Arg Trp Asn Asn Val Leu Gly Gln Arg Tyr
595 600 605
Thr Leu Ala Asp Gly Tyr Asn Thr Ala Gly Ser Asn Ala Phe Val Asn
610 615 620
Pro Ser Trp Arg Met
625

<210> 25
<211> 1734
<212> DNA
<213> Bordetella pertussis

<400> 25
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gacgatcccg acgatccgcg ggtattcgaa ggcagcaccg ccacccgtac cgccacaccg 180
ctgcgggagg tgccgcagac ggtcgacacc gtgaaggtgc cggacgccct gaactatggc 240
gcgcgcacgc tgggcgaggc gctggccggc gtgcccaatg tcaccgacgc cagcgatacc 300
cgcttcgacg gcttgcgcat acgcgggttc gacgccggca gcgacttcta cctggacggg 360
gtgcgcgatg acagccagta cgtgcgcgac ctgcacaaca tcgagcgcat cgaggtgctc 420
aaggggccgg ccggcgttct gtacggccgc ggcagccagg gcggcatcgt caatcgggtg 480
agcaaggcgc ccgggccggg ccgcgcttcc accctcgaag tccggctggg cggcgaggac 540
tttcgcagcc tgtacgccga cctgagcgcg gacccttccg acacggtcag cctgcgcctg 600
aacgtgggcg gcgagaatgc gggcagtttc aggcacgggg tcagctcgcg ccgccgcctg 660
gcgtcgcccg ccttggcgtg gcgcattacg ccacggctcg attggctggc gcagtacgaa 720

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cacagccgct acgaccgcgt gcccgaccgc ggcattccct cggtggacgg ccggcccgcg 780
ccggtcgggc gctcgaccgt ctacggcgac cccgggcgcg acaatatcga cgatcgggtc 840
caggtgctgc gctcgcgcct gcgctaccgg gcggccaatg gatgggagct gcgccatacc 900
ctgtcgacgt tccggctgca tagcgatttc gacaacacct atctgtccgg ctggcgcgcc 960
gagaccgggc tggtgcaacg ccagcgctgg cagcagcacc tgcgcgcccg gcatctttac 1020
aacgtcttcg aggccgaggg cacgttcgcc accggctggc tcgaacaccg cttgctggcc 1080
ggcgtcgagc tgggcagcca gcatcgcgat ccgacgctgc accgcgcggc caccaaaggc 1140
cccggcgcgc agccggtgcc cgggctggcg ctgcaccacc ccgacttgag ccagcagcac 1200
cacggccgca tggagcgcgc cagcgatgcg cgtcaccgcg tgcgtacgca aggctactac 1260
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cggttcgggg tgcgcacgcg caatcgcctg ctgggcctgg aaggcagccg tggcgaccgc 1380
agtgtgagtc cgcgcctggg agtggtctgg acgccctggc cggcgcacgc gttctacgcg 1440
tcgtacagca agactttctc gcccaccggc ggcggcacca taggcatcac gccggacgcg 1500
cggggcaacg ccaatgatct gccgcccgaa catacgcgcc agtacgaagc cggggtcaag 1560
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aaccgccgca cgcgcgcgcc ccacgatccc acgcggatac tcctgacggg cctgcagcgc 1680
tcgcgcggcc tggaaatgag cggggcgggg cggctagctg tgaagattca atag       1734
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<210> 26
<211> 577
<212> PRT
<213> Bordetella pertussis

<400> 26

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Met Ile Pro Pro Cys Arg Leu Ser Leu Ile Pro Ala Leu Ala Ala Met
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Ala Leu Ala Gly Ala Phe Pro Ala Pro Ser Gly Ala Ala Pro Ala Glu
            20                  25                  30
Leu Ala Pro Ile Ala Val Ile Gly Asp Asp Pro Asp Asp Pro Arg Val
        35                  40                  45
Phe Glu Gly Ser Thr Ala Thr Arg Thr Ala Thr Pro Leu Arg Glu Val
    50                  55                  60
Pro Gln Thr Val Asp Thr Val Lys Val Pro Asp Ala Leu Asn Tyr Gly
65                  70                  75                  80
Ala Arg Thr Leu Gly Glu Ala Leu Ala Gly Val Pro Asn Val Thr Asp
                85                  90                  95
Ala Ser Asp Thr Arg Phe Asp Gly Leu Arg Ile Arg Gly Phe Asp Ala
            100                 105                 110
Gly Ser Asp Phe Tyr Leu Asp Gly Val Arg Asp Asp Ser Gln Tyr Val
        115                 120                 125
Arg Asp Leu His Asn Ile Glu Arg Ile Glu Val Leu Lys Gly Pro Ala
    130                 135                 140
Gly Val Leu Tyr Gly Arg Gly Ser Gln Gly Gly Ile Val Asn Arg Val
145                 150                 155                 160
Ser Lys Ala Pro Gly Pro Gly Arg Ala Ser Thr Leu Glu Val Arg Leu
                165                 170                 175
Gly Gly Glu Asp Phe Arg Ser Leu Tyr Ala Asp Leu Ser Ala Asp Pro
            180                 185                 190
Ser Asp Thr Val Ser Leu Arg Leu Asn Val Gly Gly Glu Asn Ala Gly
        195                 200                 205
Ser Phe Arg His Gly Val Ser Ser Arg Arg Arg Leu Ala Ser Pro Ala
    210                 215                 220
Leu Ala Trp Arg Ile Thr Pro Arg Leu Asp Trp Leu Ala Gln Tyr Glu
225                 230                 235                 240
His Ser Arg Tyr Asp Arg Val Pro Asp Arg Gly Ile Pro Ser Val Asp
                245                 250                 255
Gly Arg Pro Ala Pro Val Gly Arg Ser Thr Val Tyr Gly Asp Pro Gly
            260                 265                 270
Arg Asp Asn Ile Asp Asp Arg Val Gln Val Leu Arg Ser Arg Leu Arg
        275                 280                 285
Tyr Arg Ala Ala Asn Gly Trp Glu Leu Arg His Thr Leu Ser Thr Phe
```

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    290                 295                 300
Arg Leu His Ser Asp Phe Asp Asn Thr Tyr Leu Ser Gly Trp Arg Ala
305                 310                 315                 320
Glu Thr Gly Leu Val Gln Arg Gln Arg Trp Gln Gln His Leu Arg Ala
                325                 330                 335
Arg His Leu Tyr Asn Val Phe Glu Ala Glu Gly Thr Phe Ala Thr Gly
            340                 345                 350
Trp Leu Glu His Arg Leu Leu Ala Gly Val Glu Leu Gly Ser Gln His
        355                 360                 365
Arg Asp Pro Thr Leu His Arg Ala Ala Thr Lys Gly Pro Gly Ala Gln
    370                 375                 380
Pro Val Pro Gly Leu Ala Leu His His Pro Asp Leu Ser Gln Gln His
385                 390                 395                 400
His Gly Arg Met Glu Arg Ala Ser Asp Ala Arg His Arg Val Arg Thr
                405                 410                 415
Gln Gly Tyr Tyr Leu Gln Asp Gln Leu Arg Leu Ser Glu Ser Trp Gln
            420                 425                 430
Val Val Ala Gly Ala Arg Leu Asp Arg Phe Gly Val Arg Thr Arg Asn
        435                 440                 445
Arg Leu Leu Gly Leu Glu Gly Ser Arg Gly Asp Arg Ser Val Ser Pro
    450                 455                 460
Arg Leu Gly Val Val Trp Thr Pro Trp Pro Ala His Ala Phe Tyr Ala
465                 470                 475                 480
Ser Tyr Ser Lys Thr Phe Ser Pro Thr Gly Gly Gly Thr Ile Gly Ile
                485                 490                 495
Thr Pro Asp Ala Arg Gly Asn Ala Asn Asp Leu Pro Pro Glu His Thr
            500                 505                 510
Arg Gln Tyr Glu Ala Gly Val Lys Ser Asp Trp Leu Asp Gly Arg Leu
        515                 520                 525
Ser Thr Met Leu Ala Val Tyr Gln Leu Glu Leu Tyr Asn Arg Arg Thr
    530                 535                 540
Arg Ala Pro His Asp Pro Thr Arg Ile Leu Leu Thr Gly Leu Gln Arg
545                 550                 555                 560
Ser Arg Gly Leu Glu Met Ser Gly Ala Gly Arg Leu Ala Val Lys Ile
                565                 570                 575
Gln
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<210> 27
<211> 1437
<212> DNA
<213> Bordetella pertussis

<400> 27
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acctcggtgc tcgatacgcc cgcgtccgtg gacgtggtcg atggccacga gctgcgcgcg 180
cgcaacctgc aggtcaacct gtccgaaggc ttggccggcg tgcccggact gcagctgcag 240
aaccgccaga attacgcgca ggacctgcag ctgtcgatac gcggcttcgg cgcgcgctcg 300
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ggccagggcc agacctcgaa catcgacatc ggctcggccg gccgcgtgga agtgctgcgc 420
ggcccgttct cggccctgta cggcaattcg tcgggcggcg tggtgcaggt gttcaccgaa 480
cagggcagcg atccgcccga ggcgacgggc agcgcggcgg cgggcagctt cggcacctgg 540
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ttcaatcgct tcacgaccga gggctatcgc gaccacagcg ccgcgcgcaa gaacctgggc 660
aacgcgcggc tgggcctgcg catggacgac ggcagccgcc tgacgctgag cgccaaccac 720
gtggacctga ccgcgcagga tccgctgggc ctgacgcgcg agcaattcga ggacgacccg 780
cgcagcgcgc cggtggccga gcgcttcgat acgcgcaaga ccgtgcgcca gacccagggc 840
ggcctgctgt acgagcgcgc cttcgacacg cgcaacgacc tgcgcgtgat gctgtactac 900
ggacaacgcc gcaccacgca ataccaatcc atcccggtgg ccgtgcagca aagccccacg 960

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caggccggcg gcgtgatcga cctgggccgc gactacggcg gcgccgacct acgctggacc 1020
tcgcgccagc aggtggccgg cctgccgctg accctgatcg gcggactggc ctatgacacc 1080
atgaaggagc agcgccgcgg ctacgacaac tacaccggcc cgcccgctgc gcccaccggc 1140
catgggcgtc aagggcgcgt tgcggcgcga cgagaccaac acggtctaca acctggaccc 1200
gtacctgcag gcctcgtggc agttcgccga gcgctggacg ctggacgcgg ggctgcgcta 1260
cagcacggtg cgcttcgact cggacgatca ttaccaggcg ccgggcaacg gcgacgacag 1320
cggacgcgcc acctatcgca aggccttgcc ggtggcggcg ctgcgctatg cggccaacga 1380
gaacctgagc ctgtacgcct cgtacggacg cggcttcgag acgcccacgc tcaatga    1437
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<210> 28
<211> 478
<212> PRT
<213> Bordetella pertussis

<400> 28

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Met Asn Thr Leu Arg Arg Leu Arg Ile Leu Gly Ala Ala Ala Thr Leu
 1               5                  10                  15
Gly Gly Pro Ala Ala Ala Gln Glu Ala Pro Ala Met Leu Glu Pro Val
            20                  25                  30
Arg Ile Ser Gly Thr Arg Thr Gly Thr Ser Val Leu Asp Thr Pro Ala
        35                  40                  45

Ser Val Asp Val Val Asp Gly His Glu Leu Arg Ala Arg Asn Leu Gln
    50                  55                  60
Val Asn Leu Ser Glu Gly Leu Ala Gly Val Pro Gly Leu Gln Leu Gln
65                  70                  75                  80
Asn Arg Gln Asn Tyr Ala Gln Asp Leu Gln Leu Ser Ile Arg Gly Phe
                85                  90                  95
Gly Ala Arg Ser Thr Phe Gly Val Arg Gly Val Arg Leu Tyr Val Asp
            100                 105                 110
Gly Ile Pro Ala Thr Met Pro Asp Gly Gln Gly Gln Thr Ser Asn Ile
        115                 120                 125
Asp Ile Gly Ser Ala Gly Arg Val Glu Val Leu Arg Gly Pro Phe Ser
    130                 135                 140
Ala Leu Tyr Gly Asn Ser Ser Gly Gly Val Val Gln Val Phe Thr Glu
145                 150                 155                 160
Gln Gly Ser Asp Pro Pro Glu Ala Thr Gly Ser Ala Ala Ala Gly Ser
                165                 170                 175
Phe Gly Thr Trp Arg Tyr Gly Ala Lys Leu Arg Gly Ala Ser Ala Ala
            180                 185                 190
Asp Gly Leu Asp Tyr Val Leu Asp Phe Asn Arg Phe Thr Thr Glu Gly
        195                 200                 205
Tyr Arg Asp His Ser Ala Ala Arg Lys Asn Leu Gly Asn Ala Arg Leu
    210                 215                 220
Gly Leu Arg Met Asp Asp Gly Ser Arg Leu Thr Leu Ser Ala Asn His
225                 230                 235                 240
Val Asp Leu Thr Ala Gln Asp Pro Leu Gly Leu Thr Arg Glu Gln Phe
                245                 250                 255
Glu Asp Asp Pro Arg Ser Ala Pro Val Ala Glu Arg Phe Asp Thr Arg
            260                 265                 270
Lys Thr Val Arg Gln Thr Gln Gly Gly Leu Leu Tyr Glu Arg Ala Phe
        275                 280                 285
Asp Thr Arg Asn Asp Leu Arg Val Met Leu Tyr Tyr Gly Gln Arg Arg
    290                 295                 300
Thr Thr Gln Tyr Gln Ser Ile Pro Val Ala Val Gln Gln Ser Pro Thr
305                 310                 315                 320
Gln Ala Gly Gly Val Ile Asp Leu Gly Arg Asp Tyr Gly Gly Ala Asp
                325                 330                 335
Leu Arg Trp Thr Ser Arg Gln Gln Val Ala Gly Leu Pro Leu Thr Leu
            340                 345                 350
Ile Gly Gly Leu Ala Tyr Asp Thr Met Lys Glu Gln Arg Arg Gly Tyr
```

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        355                 360                 365
Asp Asn Tyr Thr Gly Pro Pro Ala Ala Pro Thr Gly His Gly Arg Gln
    370                 375                 380
Gly Arg Val Ala Ala Arg Arg Asp Gln His Gly Leu Gln Pro Gly Pro

385                 390                 395                 400
Val Pro Ala Gly Leu Val Ala Val Arg Arg Ala Leu Asp Ala Gly Arg
                405                 410                 415
Gly Ala Ala Leu Gln His Gly Ala Leu Arg Leu Gly Arg Ser Leu Pro
            420                 425                 430
Gly Ala Gly Gln Arg Arg Arg Gln Arg Thr Arg His Leu Ser Gln Gly
        435                 440                 445
Leu Ala Gly Gly Gly Ala Ala Leu Cys Gly Gln Arg Glu Pro Glu Pro
    450                 455                 460
Val Arg Leu Val Arg Thr Arg Leu Arg Asp Ala His Ala Gln
465                 470                 475
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<210> 29
<211> 2733
<212> DNA
<213> Bordetella pertussis

<400> 29

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atgaacatgt ctctgtcacg cattgtcaag gcggcgcccc tgcgccgcac cacgctggcc 60
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atcgtcaaga ccggtgagcg ccagcatggc atccatatcc agggctccga cccgggcggc 180
gtacggaccg ccagcggaac caccatcaag gtaagcggcc gtcaggccca gggcatcctg 240
ctagaaaatc ccgcggccga gctgcagttc cggaacggca gtgtcacgtc gtcgggacag 300
ttgtccgacg atggcatccg gcgctttctg ggcaccgtca ccgtcaaggc cggcaagctg 360
gtcgccgatc acgccacgct ggccaacgtt ggcgacacct gggacgacga cggcatcgcg 420
ctctatgtgg ccggcgaaca ggcccaggcc agcatcgccg acagcaccct gcagggcgct 480
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gtggtgctgc gcgacaccaa cgtgaccgcc gtgcccgcca gcggcgcgcc cgcggcggtg 660
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gagctgccct ccattcccgg cacgtcgatc gggccgctcg acgtggcgct ggccagccag 1260
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ccggcgggca gggagttgtc cgccgccgcc aacgcggcgg tcaacacggg tggggtgggc 1860
ctggccagca cgctctggta cgccgaaagc aatgcgttgt ccaagcgcct gggcgagttg 1920
cgcctgaatc cggacgccgg cggcgcctgg ggccgcggct tcgcgcaacg ccagcagctg 1980
gacaaccgcg ccgggcggcg cttcgaccag aaggtggccg gcttcgagct gggcgccgac 2040
cacgcggtgg cggtggccgg cggacgctgg cacctgggcg ggctggccgg ctatacgcgc 2100
ggcgaccgcg gcttcaccgg cgacggcggc ggccacaccg acagcgtgca tgtcgggggc 2160
tatgccacat atatcgccga cagcggtttc tacctggacg cgacgctgcg cgccagccgc 2220
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ctggagaatg acttcaaggt ggcgggcagc gacgggtacg cggtcaaggg caagtaccgc 2280
acccatgggg tgggcgcctc gctcgaggcg ggccggcgct ttacccatgc cgacggctgg 2340
ttcctcgagc cgcaggccga gctggcggta ttccgggccg gcggcggtgc gtaccgcgcg 2400
gccaacggcc tgcgggtgcg cgacgaaggc ggcagctcgg tgctgggtcg cctgggcctg 2460
gaggtcggca agcgcatcga actggcaggc ggcaggcagg tgcagccata catcaaggcc 2520
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accgaactgc gcggcacgcg cgccgaactg ggcctgggca tggccgccgc gctgggccgc 2640
ggccacagcc tgtatgcctc gtacgagtac tccaagggcc cgaagctggc catgccgtgg 2700
accttccacg cgggctaccg gtacagctgg taa 2733

<210> 30
<211> 910
<212> PRT
<213> Bordetella pertussis

<400> 30
Met Asn Met Ser Leu Ser Arg Ile Val Lys Ala Ala Pro Leu Arg Arg
 1   5   10   15
Thr Thr Leu Ala Met Ala Leu Gly Ala Leu Gly Ala Ala Pro Ala Ala
            20   25   30
His Ala Asp Trp Asn Asn Gln Ser Ile Val Lys Thr Gly Glu Arg Gln
        35   40   45
His Gly Ile His Ile Gln Gly Ser Asp Pro Gly Gly Val Arg Thr Ala
    50   55   60
Ser Gly Thr Thr Ile Lys Val Ser Gly Arg Gln Ala Gln Gly Ile Leu
65   70   75   80
Leu Glu Asn Pro Ala Ala Glu Leu Gln Phe Arg Asn Gly Ser Val Thr
                85   90   95
Ser Ser Gly Gln Leu Ser Asp Asp Gly Ile Arg Arg Phe Leu Gly Thr
            100   105   110
Val Thr Val Lys Ala Gly Lys Leu Val Ala Asp His Ala Thr Leu Ala
        115   120   125
Asn Val Gly Asp Thr Trp Asp Asp Asp Gly Ile Ala Leu Tyr Val Ala
    130   135   140
Gly Glu Gln Ala Gln Ala Ser Ile Ala Asp Ser Thr Leu Gln Gly Ala
145   150   155   160
Gly Gly Val Gln Ile Glu Arg Gly Ala Asn Val Thr Val Gln Arg Ser
                165   170   175
Ala Ile Val Asp Gly Gly Leu His Ile Gly Ala Leu Gln Ser Leu Gln
            180   185   190
Pro Glu Asp Leu Pro Pro Ser Arg Val Val Leu Arg Asp Thr Asn Val
        195   200   205
Thr Ala Val Pro Ala Ser Gly Ala Pro Ala Ala Val Ser Val Leu Gly
    210   215   220
Ala Ser Glu Leu Thr Leu Asp Gly Gly His Ile Thr Gly Gly Arg Ala
225   230   235   240
Ala Gly Val Ala Ala Met Gln Gly Ala Val Val His Leu Gln Arg Ala
                245   250   255
Thr Ile Arg Arg Gly Asp Ala Pro Ala Gly Gly Ala Val Pro Gly Gly
            260   265   270
Ala Val Pro Gly Gly Ala Val Pro Gly Gly Phe Gly Pro Gly Gly Phe
        275   280   285
Gly Pro Val Leu Asp Gly Trp Tyr Gly Val Asp Val Ser Gly Ser Ser
    290   295   300
Val Glu Leu Ala Gln Ser Ile Val Glu Ala Pro Glu Leu Gly Ala Ala
305   310   315   320
Ile Arg Val Gly Arg Gly Ala Arg Val Thr Val Ser Gly Gly Ser Leu
                325   330   335
Ser Ala Pro His Gly Asn Val Ile Glu Thr Gly Gly Ala Arg Arg Phe
            340   345   350
Ala Pro Gln Ala Ala Pro Leu Ser Ile Thr Leu Gln Ala Gly Ala His

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        355                 360                 365
Ala Gln Gly Lys Ala Leu Leu Tyr Arg Val Leu Pro Glu Pro Val Lys
    370                 375                 380
Leu Thr Leu Thr Gly Gly Ala Asp Ala Gln Gly Asp Ile Val Ala Thr
385                 390                 395                 400
Glu Leu Pro Ser Ile Pro Gly Thr Ser Ile Gly Pro Leu Asp Val Ala
                405                 410                 415
Leu Ala Ser Gln Ala Arg Trp Thr Gly Ala Thr Arg Ala Val Asp Ser
            420                 425                 430
Leu Ser Ile Asp Asn Ala Thr Trp Val Met Thr Asp Asn Ser Asn Val
        435                 440                 445
Gly Ala Leu Arg Leu Ala Ser Asp Gly Ser Val Asp Phe Gln Gln Pro
    450                 455                 460
Ala Glu Ala Gly Arg Phe Lys Val Leu Thr Val Asn Thr Leu Ala Gly
465                 470                 475                 480
Ser Gly Leu Phe Arg Met Asn Val Phe Ala Asp Leu Gly Leu Ser Asp
                485                 490                 495
Lys Leu Val Val Met Gln Asp Ala Ser Gly Gln His Arg Leu Trp Val
            500                 505                 510
Arg Asn Ser Gly Ser Glu Pro Ala Ser Ala Asn Thr Leu Leu Leu Val
        515                 520                 525
Gln Thr Pro Leu Gly Ser Ala Ala Thr Phe Thr Leu Ala Asn Lys Asp
    530                 535                 540
Gly Lys Val Asp Ile Gly Thr Tyr Arg Tyr Arg Leu Ala Ala Asn Gly
545                 550                 555                 560
Asn Gly Gln Trp Ser Leu Val Gly Ala Lys Ala Pro Pro Ala Pro Lys
                565                 570                 575
Pro Ala Pro Gln Pro Gly Pro Gln Pro Pro Gln Pro Pro Gln Pro Gln
            580                 585                 590
Pro Glu Ala Pro Ala Pro Gln Pro Pro Ala Gly Arg Glu Leu Ser Ala
        595                 600                 605
Ala Ala Asn Ala Ala Val Asn Thr Gly Gly Val Gly Leu Ala Ser Thr
    610                 615                 620
Leu Trp Tyr Ala Glu Ser Asn Ala Leu Ser Lys Arg Leu Gly Glu Leu
625                 630                 635                 640
Arg Leu Asn Pro Asp Ala Gly Gly Ala Trp Gly Arg Gly Phe Ala Gln
                645                 650                 655
Arg Gln Gln Leu Asp Asn Arg Ala Gly Arg Arg Phe Asp Gln Lys Val
            660                 665                 670
Ala Gly Phe Glu Leu Gly Ala Asp His Ala Val Ala Val Ala Gly Gly
        675                 680                 685
Arg Trp His Leu Gly Gly Leu Ala Gly Tyr Thr Arg Gly Asp Arg Gly
    690                 695                 700
Phe Thr Gly Asp Gly Gly Gly His Thr Asp Ser Val His Val Gly Gly
705                 710                 715                 720
Tyr Ala Thr Tyr Ile Ala Asp Ser Gly Phe Tyr Leu Asp Ala Thr Leu
                725                 730                 735
Arg Ala Ser Arg Leu Glu Asn Asp Phe Lys Val Ala Gly Ser Asp Gly
            740                 745                 750
Tyr Ala Val Lys Gly Lys Tyr Arg Thr His Gly Val Gly Ala Ser Leu
        755                 760                 765
Glu Ala Gly Arg Arg Phe Thr His Ala Asp Gly Trp Phe Leu Glu Pro
    770                 775                 780
Gln Ala Glu Leu Ala Val Phe Arg Ala Gly Gly Gly Ala Tyr Arg Ala
785                 790                 795                 800
Ala Asn Gly Leu Arg Val Arg Asp Glu Gly Gly Ser Ser Val Leu Gly
                805                 810                 815
Arg Leu Gly Leu Glu Val Gly Lys Arg Ile Glu Leu Ala Gly Gly Arg
            820                 825                 830
Gln Val Gln Pro Tyr Ile Lys Ala Ser Val Leu Gln Glu Phe Asp Gly
        835                 840                 845
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Ala Gly Thr Val His Thr Asn Gly Ile Ala His Arg Thr Glu Leu Arg
    850                 855                 860
Gly Thr Arg Ala Glu Leu Gly Leu Gly Met Ala Ala Ala Leu Gly Arg
865                 870                 875                 880
Gly His Ser Leu Tyr Ala Ser Tyr Glu Tyr Ser Lys Gly Pro Lys Leu
                885                 890                 895
Ala Met Pro Trp Thr Phe His Ala Gly Tyr Arg Tyr Ser Trp
            900                 905                 910
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<210> 31
<211> 2748
<212> DNA
<213> Bordetella pertussis

<400> 31

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acggcagcgc agcgaataga tggcggcgcg gcgtttctgg gcgatgtcgc catagcgacg 180
accaaggcgt ccgagcacgg tatcaacgtg actggccgca cggcagaggt tcgggtgacg 240
ggcggcacca tacggacgag cggcaaccag gcccagggct tgcgggtcgg cacggagaat 300
gcaccggaca acaccgcgct gggcgcgtcg gtctttttgc agaacctgat catcgagact 360
tccgggaccg gggcattggg cgtctctgtc cacgagccac agggaggagg aggcacgcgc 420
ttgtccatgt ccgggacgac ggtgcgcacg cgcggcgatg acagtttcgc cctgcagctt 480
tcagggcctg ccagcgccac cttgaatgac gtggcgctgg agacggccgg ccagcaggcg 540
cccgcggtgg tgctgtggca aggcgcacag ttgaacgcac aggggctggt ggttcaggtc 600
aacggggcag gcgtttccgc gatacatgcg caggatgccg gcagcttcac gttgtcgggc 660
tcggatatta ccgcccgggg cctggaagtc gccgggatct atgtgcagga aggcatgcag 720
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gaggacgcgg gtacgcacgt cagcatgaac ggcggcgcgt tgtcgacctc cggcgcgaat 840
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catgcgcagg tgcgggccga cgggcaaggg gctcatggcc tggtggtgac gcgaagcagc 1020
gcgatggtgc gggcgggttc actggtagag agcaccggag acggcgccgc ggcgctgctg 1080
gaaagcgggc atcttacggt ggacggcagc gtggtccatg gccacggcgc ggccgggttg 1140
gaggtcgacg gcgagagtaa tgtgtccctg ctcaacggcg cacgcctgtc gtcggaccag 1200
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ttgcgcgccg gggcggaggc gggccggcag atgaggttgg ccaatggcaa tatcgttgaa 2520
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gccttgctgg gcaagcggca tgccttgtac gccgactacg agtatgccaa gggcgcgcgg 2700
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<211> 915
<212> PRT
<213> Bordetella pertussis

<400> 32
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Asp Val Ala Gly Ala Ala Ala Val Thr Ala Ala Gln Arg Ile Asp Gly
35 40 45
Gly Ala Ala Phe Leu Gly Asp Val Ala Ile Ala Thr Thr Lys Ala Ser
50 55 60
Glu His Gly Ile Asn Val Thr Gly Arg Thr Ala Glu Val Arg Val Thr
65 70 75 80
Gly Gly Thr Ile Arg Thr Ser Gly Asn Gln Ala Gln Gly Leu Arg Val
85 90 95
Gly Thr Glu Asn Ala Pro Asp Asn Thr Ala Leu Gly Ala Ser Val Phe
100 105 110
Leu Gln Asn Leu Ile Ile Glu Thr Ser Gly Thr Gly Ala Leu Gly Val
115 120 125
Ser Val His Glu Pro Gln Gly Gly Gly Gly Thr Arg Leu Ser Met Ser
130 135 140
Gly Thr Thr Val Arg Thr Arg Gly Asp Asp Ser Phe Ala Leu Gln Leu
145 150 155 160
Ser Gly Pro Ala Ser Ala Thr Leu Asn Asp Val Ala Leu Glu Thr Ala
165 170 175
Gly Gln Gln Ala Pro Ala Val Val Leu Trp Gln Gly Ala Gln Leu Asn
180 185 190
Ala Gln Gly Leu Val Val Gln Val Asn Gly Ala Gly Val Ser Ala Ile
195 200 205
His Ala Gln Asp Ala Gly Ser Phe Thr Leu Ser Gly Ser Asp Ile Thr
210 215 220
Ala Arg Gly Leu Glu Val Ala Gly Ile Tyr Val Gln Glu Gly Met Gln
225 230 235 240
Gly Thr Leu Thr Gly Thr Arg Val Thr Thr Gln Gly Asp Thr Ala Pro
245 250 255
Ala Leu Gln Val Glu Asp Ala Gly Thr His Val Ser Met Asn Gly Gly
260 265 270
Ala Leu Ser Thr Ser Gly Ala Asn Ser Pro Ala Ala Trp Leu Leu Ala
275 280 285
Gly Gly Ser Ala Gln Phe Arg Asp Thr Val Leu Arg Thr Val Gly Glu
290 295 300
Ala Ser His Gly Val Asp Val Ala Ala His Ser Glu Val Glu Leu Ala
305 310 315 320
His Ala Gln Val Arg Ala Asp Gly Gln Gly Ala His Gly Leu Val Val
325 330 335
Thr Arg Ser Ser Ala Met Val Arg Ala Gly Ser Leu Val Glu Ser Thr
340 345 350
Gly Asp Gly Ala Ala Ala Leu Leu Glu Ser Gly His Leu Thr Val Asp
355 360 365
Gly Ser Val Val His Gly His Gly Ala Ala Gly Leu Glu Val Asp Gly
370 375 380
Glu Ser Asn Val Ser Leu Leu Asn Gly Ala Arg Leu Ser Ser Asp Gln
385 390 395 400
Pro Thr Ala Ile Arg Leu Ile Asp Pro Arg Ser Val Leu Asn Leu Asp
405 410 415
Ile Lys Asp Arg Ala Gln Leu Leu Gly Asp Ile Ala Pro Glu Ala Gln

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                420                 425                 430
Gln Pro Asp Gly Ser Pro Glu Gln Ala Arg Val Arg Val Ala Leu Ala
        435                 440                 445
Asp Gly Gly Thr Trp Ala Gly Arg Thr Asp Gly Ala Val His Thr Val
    450                 455                 460
Arg Leu Leu Asp Arg Gly Val Trp Thr Val Thr Gly Asp Ser Arg Val
465                 470                 475                 480
Ala Glu Val Lys Leu Glu Gly Gly Thr Leu Ala Phe Ala Pro Pro Ala
                485                 490                 495
Gln Pro Lys Gly Ala Phe Lys Thr Leu Val Ala Thr Gln Gly Ile Ser
            500                 505                 510
Gly Thr Gly Thr Ile Val Met Asn Ala His Leu Pro Ser Gly Thr Ala
        515                 520                 525
Asp Val Leu Val Ala Pro Gln Gly Phe Gly Asp Arg Gln Val Leu Val
    530                 535                 540
Val Asn Asn Thr Asp Asp Gly Thr Glu Ser Gly Ala Thr Lys Val Pro
545                 550                 555                 560
Leu Ile Glu Asp Glu Gln Gly His Thr Ala Phe Thr Leu Gly Asn Met
                565                 570                 575
Gly Gly Arg Val Asp Ala Gly Ala Arg Gln Tyr Glu Leu Thr Ala Ser
            580                 585                 590
Glu Ala Gln Ala Asp Lys Ala Arg Thr Trp Gln Leu Thr Pro Thr Asn
        595                 600                 605
Glu Leu Ser Thr Thr Ala Thr Ala Ala Val Asn Ala Met Ala Ile Ala
    610                 615                 620
Ala Ser Gln Arg Ile Trp Gln Ala Glu Met Asp Val Leu Leu Arg His
625                 630                 635                 640
Met Ser Gly Leu His Ser Ile Gly Ser Pro Gly Gly Phe Trp Ala Arg
                645                 650                 655
Gly Leu Ser Gln Arg Gln Arg Leu Asp Thr Gly Tyr Gly Pro Trp Gln
            660                 665                 670
Lys Gln Thr Val Ser Gly Ile Glu Leu Gly Leu Asp Arg Arg Val Ala
        675                 680                 685
Gly Gly Ala Thr Thr Ala Trp Ser Val Gly Met Leu Ala Gly Tyr Ser
    690                 695                 700
Glu Thr Arg Arg Asp Gly Gly Ala Tyr Arg Ala Gly His Val His Ser
705                 710                 715                 720
Ala His Val Gly Ala Tyr Val Ser Tyr Leu Asn Asp Ser Gly Ser Tyr
                725                 730                 735
Val Asp Gly Val Val Lys Tyr Asn Arg Phe Arg His Gly Phe Asp Ile
            740                 745                 750
Arg Thr Thr Asp Leu Lys Arg Val Asp Ala Lys His Arg Ser His Gly
        755                 760                 765
Leu Gly Ala Leu Leu Arg Gly Gly Arg Arg Ile Asp Ile Asp Gly Gly
    770                 775                 780
Trp Tyr Val Glu Pro Gln Ala Ser Val Ala Trp Phe His Ala Gly Gly
785                 790                 795                 800
Ser Arg Tyr Glu Ala Ser Asn Gly Leu Arg Val Arg Ala Asp Gly Ala
                805                 810                 815
His Ser Trp Val Leu Arg Ala Gly Ala Glu Ala Gly Arg Gln Met Arg
            820                 825                 830
Leu Ala Asn Gly Asn Ile Val Glu Pro Tyr Ala Arg Leu Gly Trp Ala
        835                 840                 845
Gln Glu Leu Gly Ala Asp Asn Ala Val Tyr Thr Asn Gly Ile Arg His
    850                 855                 860
Val Thr Arg Ser Arg Gly Gly Phe Ala Glu Ala Arg Val Gly Val Gly
865                 870                 875                 880
Ala Leu Leu Gly Lys Arg His Ala Leu Tyr Ala Asp Tyr Glu Tyr Ala
                885                 890                 895
Lys Gly Ala Arg Phe Glu Ala Pro Trp Thr Leu Gln Leu Gly Tyr Arg
            900                 905                 910
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Tyr Ser Trp

915

<210> 33
<211> 3033
<212> DNA
<213> Bordetella pertussis

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gcggcgcagg cgccgcagcc gcccgtggcc ggcgcgccgc atgcgcagga cgccgggcag 180
gaaggagagt tcgaccaccg ggacaacacg ctcattgcag tctttgacga cggcgtcggc 240
atcaatctcg acgacgatcc cgacgagctc ggcgagacgg cgccccccac gctcaaggac 300
atccacatct cggtggagca caagaacccg atgagcaagc cggccatcgg ggtgcgtgtc 360
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tcgttccacg ccggctaccg ctacagcttc tga 3033

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<212> PRT
<213> Bordetella pertussis

<400> 34
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Gly Met Ala Arg Leu Ala Pro Ala Ala Ala Gln Ala Pro Gln Pro Pro
35 40 45
Val Ala Gly Ala Pro His Ala Gln Asp Ala Gly Gln Glu Gly Glu Phe
50 55 60
Asp His Arg Asp Asn Thr Leu Ile Ala Val Phe Asp Asp Gly Val Gly
65 70 75 80
Ile Asn Leu Asp Asp Asp Pro Asp Glu Leu Gly Glu Thr Ala Pro Pro
85 90 95
Thr Leu Lys Asp Ile His Ile Ser Val Glu His Lys Asn Pro Met Ser
100 105 110
Lys Pro Ala Ile Gly Val Arg Val Ser Gly Ala Gly Arg Ala Leu Thr
115 120 125
Leu Ala Gly Ser Thr Ile Asp Ala Thr Glu Gly Gly Ile Pro Ala Val
130 135 140
Val Arg Arg Gly Gly Thr Leu Glu Leu Asp Gly Val Thr Val Ala Gly
145 150 155 160
Gly Glu Gly Met Glu Pro Met Thr Val Ser Asp Ala Gly Ser Arg Leu
165 170 175
Ser Val Arg Gly Gly Val Leu Gly Gly Glu Ala Pro Gly Val Gly Leu
180 185 190
Val Arg Ala Ala Gln Gly Gly Gln Ala Ser Ile Ile Asp Ala Thr Leu
195 200 205
Gln Ser Ile Leu Gly Pro Ala Leu Ile Ala Asp Gly Gly Ser Ile Ser
210 215 220
Val Ala Gly Gly Ser Ile Asp Met Asp Met Gly Pro Gly Phe Pro Pro
225 230 235 240
Pro Pro Pro Pro Leu Pro Gly Ala Pro Leu Ala Ala His Pro Pro Leu
245 250 255
Asp Arg Val Ala Ala Val His Ala Gly Gln Asp Gly Lys Val Thr Leu
260 265 270
Arg Glu Val Ala Leu Arg Ala His Gly Pro Gln Ala Thr Gly Val Tyr
275 280 285
Ala Tyr Met Pro Gly Ser Glu Ile Thr Leu Gln Gly Gly Thr Val Ser
290 295 300
Val Gln Gly Asp Asp Gly Ala Gly Val Val Ala Gly Ala Gly Leu Leu
305 310 315 320
Asp Ala Leu Pro Pro Gly Gly Thr Val Arg Leu Asp Gly Thr Thr Val
325 330 335
Ser Thr Asp Gly Ala Asn Thr Asp Ala Val Leu Val Arg Gly Asp Ala
340 345 350
Ala Arg Ala Glu Val Val Asn Thr Val Leu Arg Thr Ala Lys Ser Leu
355 360 365
Ala Ala Gly Val Ser Ala Gln His Gly Gly Arg Val Thr Leu Arg Gln
370 375 380
Thr Arg Ile Glu Thr Ala Gly Ala Gly Ala Glu Gly Ile Ser Val Leu
385 390 395 400
Gly Phe Glu Pro Gln Ser Gly Ser Gly Pro Ala Ser Val Asp Met Gln
405 410 415
Gly Gly Ser Ile Thr Thr Thr Gly Asn Arg Ala Ala Gly Ile Ala Leu

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                420                 425                 430
Thr His Gly Ser Ala Arg Leu Glu Gly Val Ala Val Arg Ala Glu Gly
        435                 440                 445
Ser Gly Ser Ser Ala Ala Gln Leu Ala Asn Gly Thr Leu Val Val Ser
    450                 455                 460
Ala Gly Ser Leu Ala Ser Ala Gln Ser Gly Ala Ile Ser Val Thr Asp
465                 470                 475                 480
Thr Pro Leu Lys Leu Met Pro Gly Ala Leu Ala Ser Ser Thr Val Ser
                485                 490                 495
Val Arg Leu Thr Asp Gly Ala Thr Ala Gln Gly Gly Asn Gly Val Phe
            500                 505                 510
Leu Gln Gln His Ser Thr Ile Pro Val Ala Val Ala Leu Glu Ser Gly
        515                 520                 525
Ala Leu Ala Arg Gly Asp Ile Val Ala Asp Gly Asn Lys Pro Leu Asp
    530                 535                 540
Ala Gly Ile Ser Leu Ser Val Ala Ser Gly Ala Ala Trp His Gly Ala
545                 550                 555                 560
Thr Gln Val Leu Gln Ser Ala Thr Leu Gly Lys Gly Gly Thr Trp Val
                565                 570                 575
Val Asn Ala Asp Ser Arg Val Gln Asp Met Ser Met Arg Gly Gly Arg
            580                 585                 590
Val Glu Phe Gln Ala Pro Ala Pro Glu Ala Ser Tyr Lys Thr Leu Thr
        595                 600                 605
Leu Gln Thr Leu Asp Gly Asn Gly Val Phe Val Leu Asn Thr Asn Val
    610                 615                 620
Ala Ala Gly Gln Asn Asp Gln Leu Arg Val Thr Gly Arg Ala Asp Gly
625                 630                 635                 640
Gln His Arg Val Leu Val Arg Asn Ala Gly Gly Glu Ala Asp Ser Arg
                645                 650                 655
Gly Ala Arg Leu Gly Leu Val His Thr Gln Gly Gln Gly Asn Ala Thr
            660                 665                 670
Phe Arg Leu Ala Asn Val Gly Lys Ala Val Asp Leu Gly Thr Trp Arg
        675                 680                 685
Tyr Ser Leu Ala Glu Asp Pro Lys Thr His Val Trp Ser Leu Gln Arg
    690                 695                 700
Ala Gly Gln Ala Leu Ser Gly Ala Ala Asn Ala Ala Val Asn Ala Ala
705                 710                 715                 720
Asp Leu Ser Ser Ile Ala Leu Ala Glu Ser Asn Ala Leu Asp Lys Arg
                725                 730                 735
Leu Gly Glu Leu Arg Leu Arg Ala Asp Ala Gly Gly Pro Trp Ala Arg
            740                 745                 750
Thr Phe Ser Glu Arg Gln Gln Ile Ser Asn Arg His Ala Arg Ala Tyr
        755                 760                 765
Asp Gln Thr Val Ser Gly Leu Glu Ile Gly Leu Asp Arg Gly Trp Ser
    770                 775                 780

Ala Ser Gly Gly Arg Trp Tyr Ala Gly Gly Leu Leu Gly Tyr Thr Tyr
785                 790                 795                 800
Ala Asp Arg Thr Tyr Pro Gly Asp Gly Gly Gly Lys Val Lys Gly Leu
                805                 810                 815
His Val Gly Gly Tyr Ala Ala Tyr Val Gly Asp Gly Gly Tyr Tyr Leu
            820                 825                 830
Asp Thr Val Leu Arg Leu Gly Arg Tyr Asp Gln Gln Tyr Asn Ile Ala
        835                 840                 845
Gly Thr Asp Gly Gly Arg Val Thr Ala Asp Tyr Arg Thr Ser Gly Ala
    850                 855                 860
Ala Trp Ser Leu Glu Gly Gly Arg Arg Phe Glu Leu Pro Asn Asp Trp
865                 870                 875                 880
Phe Ala Glu Pro Gln Ala Glu Val Met Leu Trp Arg Thr Ser Gly Lys
                885                 890                 895
Arg Tyr Arg Ala Ser Asn Gly Leu Arg Val Lys Val Asp Ala Asn Thr
```

```
            900                 905                 910
Ala Thr Leu Gly Arg Leu Gly Leu Arg Phe Gly Arg Arg Ile Ala Leu
        915                 920                 925
Ala Gly Gly Asn Ile Val Gln Pro Tyr Ala Arg Leu Gly Trp Thr Gln
    930                 935                 940
Glu Phe Lys Ser Thr Gly Asp Val Arg Thr Asn Gly Ile Gly His Ala
945                 950                 955                 960
Gly Ala Gly Arg His Gly Arg Val Glu Leu Gly Ala Gly Val Asp Ala
                965                 970                 975
Ala Leu Gly Lys Gly His Asn Leu Tyr Ala Ser Tyr Glu Tyr Ala Ala
            980                 985                 990
Gly Asp Arg Ile Asn Ile Pro Trp Ser Phe His Ala Gly Tyr Arg Tyr
        995                 1000                1005
Ser Phe
    1010
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<210> 35
<211> 1944
<212> DNA
<213> Bordetella pertussis

<400> 35

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atgcacattt acggaaatat gaatcgagca acaccttgcc gcggtgcggt gcgtgccctt 60
gcgcttgccc tgctgggagc gggtatgtgg acactttctc ctccctcggc atgggcgctt 120
aagctcccgt cgctgctgac ggacgacgag ctgaagctgg ttctgccgac tggcatgtct 180
ctggaggatt tcaagcgcag ccttcaggag tccgcgccga gcgcgctggc aacgccgccg 240
tcgtcttcgc ctccggttgc gaagccaggt ccgggctccg ttgccgaggc tccgtcgggg 300
tcgggccaca aggacaaccc atcccctccc gtcgtcggcg tcggtccagg tatggcggag 360
tcgtctggcg gacataaccc cggcgtgggg gggggcacgc atgaaaatgg gttgcccggt 420
ataggaaagg tcggcgggtc tgcgcccgga ccggatacca gtacgggctc gggtcccgac 480
gccggcatgg cgtccggagc gggttcgacg tcgcccggcg catcgggtgg ggcgggcaag 540
gatgcgatgc cgccctcgga aggcgagagg ccggactccg gtatgtccga ttcggggcgg 600
ggtggcgaat cgtcggctgg aggcttgaat ccggacggcg ctggcaagcc accgcgggag 660
gaaggcgagc cgggttccaa gtctcctgcg gacggtggcc aggacgggcc gccgccgccc 720
cgggacggcg gcgatgcgga tccgcaacct ccgcgggacg atggcaatgg ggaacagcag 780
ccgcccaagg gcggcgggga tgaggggcag cgcccgccgc ctgccgccgg aaacggtggc 840
aacggtggca acgggaacgc gcagcttccc gagcgcggcg acgacgcggg tccgaagcct 900
cccgagggag agggcggcga tgaaggtccg caaccgccgc agggcggcgg cgagcaggac 960
gcgccggagg ttcctcccgt cgcgccggcg ccgcccgcgg gcaacggtgt ctatgacccg 1020
ggcacgcata ccttgaccac gccggcctct gcggcggtga gcctggccag cagttcgcat 1080
ggcgtatggc aggccgagat gaacgcgttg agcaagcgca tgggcgagtt gcgcctgacg 1140
ccggttgcgg gcggcgtatg gggccgcgct tttggccggc gccaggacgt cgacaaccgc 1200
gtgtcgcgcg agttccgcca gaccatcagc ggtttcgaac tgggcgccga taccgccttg 1260
ccggtggccg acgggcgctg gcacgtgggc gcggtggctg gctacaccaa cggccgcatc 1320
aagttcgacc ggggcggcac gggcgatgac gacagcgtgc acgtgggcgc ttacgctacc 1380
tacatcgagg acggcggttt ctatatggat ggcatcgtgc gggtcagccg cattcgccac 1440
gcgttcaagg tggacgacgc caagggccgg cgcgtgcgcg gccagtaccg cggcaatggc 1500
gtgggcgcgt cgctggaact gggcaagcgc ttcacgtggc ccggcgcctg gtacgtggag 1560
ccgcagctgg aggtggccgc cttccatgcg caaggggccg actacaccgc cagcaacggc 1620
ctgcgcatca aggacgacgg cacgaactcc atgctgggcc gcctgggcct gcacgtgggg 1680
cggcagttcg acctgggcga tggccgcgtg gtgcagccct acatgaagct gagctgggtg 1740
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gatggcggcc gcaccgaact ggccgtaggg gtggcttcgc aactgggcaa gcacggcagc 1860
ctgttcggct cgtacgagta cgccaagggc agccgccaga ccatgccgtg gaccttccac 1920
gtcggctatc gctacgcctg gtag                                        1944
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<210> 36
<211> 647
<212> PRT
<213> Bordetella pertussis

<400> 36
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1 5 10 15
Val Arg Ala Leu Ala Leu Ala Leu Leu Gly Ala Gly Met Trp Thr Leu
20 25 30
Ser Pro Pro Ser Ala Trp Ala Leu Lys Leu Pro Ser Leu Leu Thr Asp
35 40 45
Asp Glu Leu Lys Leu Val Leu Pro Thr Gly Met Ser Leu Glu Asp Phe
50 55 60
Lys Arg Ser Leu Gln Glu Ser Ala Pro Ser Ala Leu Ala Thr Pro Pro
65 70 75 80
Ser Ser Ser Pro Pro Val Ala Lys Pro Gly Pro Gly Ser Val Ala Glu
85 90 95
Ala Pro Ser Gly Ser Gly His Lys Asp Asn Pro Ser Pro Pro Val Val
100 105 110
Gly Val Gly Pro Gly Met Ala Glu Ser Ser Gly Gly His Asn Pro Gly
115 120 125
Val Gly Gly Gly Thr His Glu Asn Gly Leu Pro Gly Ile Gly Lys Val
130 135 140
Gly Gly Ser Ala Pro Gly Pro Asp Thr Ser Thr Gly Ser Gly Pro Asp
145 150 155 160
Ala Gly Met Ala Ser Gly Ala Gly Ser Thr Ser Pro Gly Ala Ser Gly
165 170 175
Gly Ala Gly Lys Asp Ala Met Pro Pro Ser Glu Gly Glu Arg Pro Asp
180 185 190
Ser Gly Met Ser Asp Ser Gly Arg Gly Gly Glu Ser Ser Ala Gly Gly
195 200 205
Leu Asn Pro Asp Gly Ala Gly Lys Pro Pro Arg Glu Glu Gly Glu Pro
210 215 220
Gly Ser Lys Ser Pro Ala Asp Gly Gly Gln Asp Gly Pro Pro Pro Pro
225 230 235 240
Arg Asp Gly Gly Asp Ala Asp Pro Gln Pro Pro Arg Asp Asp Gly Asn
245 250 255
Gly Glu Gln Gln Pro Pro Lys Gly Gly Gly Asp Glu Gly Gln Arg Pro
260 265 270
Pro Pro Ala Ala Gly Asn Gly Gly Asn Gly Gly Asn Gly Asn Ala Gln
275 280 285
Leu Pro Glu Arg Gly Asp Asp Ala Gly Pro Lys Pro Pro Glu Gly Glu
290 295 300
Gly Gly Asp Glu Gly Pro Gln Pro Pro Gln Gly Gly Gly Glu Gln Asp
305 310 315 320
Ala Pro Glu Val Pro Pro Val Ala Pro Ala Pro Pro Ala Gly Asn Gly
325 330 335
Val Tyr Asp Pro Gly Thr His Thr Leu Thr Thr Pro Ala Ser Ala Ala
340 345 350
Val Ser Leu Ala Ser Ser Ser His Gly Val Trp Gln Ala Glu Met Asn
355 360 365
Ala Leu Ser Lys Arg Met Gly Glu Leu Arg Leu Thr Pro Val Ala Gly
370 375 380
Gly Val Trp Gly Arg Ala Phe Gly Arg Arg Gln Asp Val Asp Asn Arg
385 390 395 400
Val Ser Arg Glu Phe Arg Gln Thr Ile Ser Gly Phe Glu Leu Gly Ala
405 410 415
Asp Thr Ala Leu Pro Val Ala Asp Gly Arg Trp His Val Gly Ala Val
420 425 430
Ala Gly Tyr Thr Asn Gly Arg Ile Lys Phe Asp Arg Gly Gly Thr Gly
435 440 445
Asp Asp Asp Ser Val His Val Gly Ala Tyr Ala Thr Tyr Ile Glu Asp
450 455 460
Gly Gly Phe Tyr Met Asp Gly Ile Val Arg Val Ser Arg Ile Arg His

```
465                 470                 475                 480
Ala Phe Lys Val Asp Asp Ala Lys Gly Arg Arg Val Arg Gly Gln Tyr
                485                 490                 495
Arg Gly Asn Gly Val Gly Ala Ser Leu Glu Leu Gly Lys Arg Phe Thr
            500                 505                 510
Trp Pro Gly Ala Trp Tyr Val Glu Pro Gln Leu Glu Val Ala Ala Phe
        515                 520                 525
His Ala Gln Gly Ala Asp Tyr Thr Ala Ser Asn Gly Leu Arg Ile Lys
    530                 535                 540
Asp Asp Gly Thr Asn Ser Met Leu Gly Arg Leu Gly Leu His Val Gly
545                 550                 555                 560
Arg Gln Phe Asp Leu Gly Asp Gly Arg Val Val Gln Pro Tyr Met Lys
                565                 570                 575
Leu Ser Trp Val Gln Glu Phe Asp Gly Lys Gly Thr Val Arg Thr Asn
            580                 585                 590
Asp Ile Arg His Lys Val Arg Leu Asp Gly Gly Arg Thr Glu Leu Ala
        595                 600                 605
Val Gly Val Ala Ser Gln Leu Gly Lys His Gly Ser Leu Phe Gly Ser
    610                 615                 620

Tyr Glu Tyr Ala Lys Gly Ser Arg Gln Thr Met Pro Trp Thr Phe His
625                 630                 635                 640
Val Gly Tyr Arg Tyr Ala Trp
                645
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<210> 37
<211> 1257
<212> DNA
<213> Bordetella pertussis

<400> 37
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gcgctggccg cgctggctgt cgcgccgctc gcgccggcgc aggcacagac tccgctgccc 120
gcgggactcg gcgccgccga ggtgcggcag tatttgtccg gcctgccgtc cgatgccctg 180
cgccagcagg cgtcgtggct ggcgccggcg ctgttgcgcc cctatctgtc aggcctgacg 240
gatgcgcaat tgcggcaata tgtgcaggcg ctgacacccg ggcagatcac gcaggggctg 300
gcggcgttga cgcctgcgca gcgtgcgcgg ctgcagcgcg aattcgaacg gcaggcgcgc 360
cggcaggtgc agcaggcggt acgggccgag gtcgccgcgc gcagcgcgcg ggcggtggcg 420
atggggcaga gcgcatcgat gctgctgctc gacgccgaga tgggaaccct ggcgcaacgc 480
cagggcgatc tgcgccgcgg ccacgacgag ggcgccttct gggcgcgcgg cagcgcgaac 540
cgcttcaagg tcgatacgcc ggacacaccg gcgttcgacc tgcgcgtgga gtacctgacg 600
ctgggcgccg accatggctg gcgcctggac acggggcggc tctatctggg cgcctacgcc 660
ggcgtctcgc gcgcccgcat ggatgacaac gacatcatgc acggccggat cgaaagccgg 720
ttcctgggca cgtacctgac ttatgtggac aacggcgggt tctacgtcga tgcggtcagc 780
aagctggggc gtatcgacga gtccgtgtcg ttcgacctgc cgctggggct gggcgactac 840
gacgacgata tatcgcatac aacgtatacg ggcagtgccg aggccggcta tcacttcaag 900
ttgccgcaac gctggttcgt cgagccgcag gcgcaggtga tctactcgcg cagcagccag 960
acgtcggtgc aggggcgggc cggcgtgcgc gccggccggg atttcaccct ggccggcggc 1020
gcgaccttgc gtccttatgt cagcgcctcg tacctgcacg agttctcgca cgacgactcg 1080
gtcgatttcg gcggcaagtc gtacgatgcc gaactgcccg gcagccgctg gcagctgggt 1140
gccggcgcgg cgctggacgt gggggcgcat cgcgcctacg cggatctgcg ctatgggcac 1200
ggcgccaaca tcagccagga cctgtcgctg aacatcggct acgcgtaccg cttctag    1257
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<210> 38
<211> 418
<212> PRT
<213> Bordetella pertussis

<400> 38
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Met Lys Pro Thr Ser Ile Leu Ala Arg Leu Pro Arg Tyr Leu Gly Ala
```

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 1               5                  10                  15
Cys Ala Leu Ala Ala Leu Ala Ala Leu Ala Val Ala Pro Leu Ala Pro
            20                  25                  30
Ala Gln Ala Gln Thr Pro Leu Pro Ala Gly Leu Gly Ala Ala Glu Val
        35                  40                  45
Arg Gln Tyr Leu Ser Gly Leu Pro Ser Asp Ala Leu Arg Gln Gln Ala
    50                  55                  60
Ser Trp Leu Ala Pro Ala Leu Leu Arg Pro Tyr Leu Ser Gly Leu Thr
65                  70                  75                  80
Asp Ala Gln Leu Arg Gln Tyr Val Gln Ala Leu Thr Pro Gly Gln Ile
                85                  90                  95
Thr Gln Gly Leu Ala Ala Leu Thr Pro Ala Gln Arg Ala Arg Leu Gln
            100                 105                 110
Arg Glu Phe Glu Arg Gln Ala Arg Arg Gln Val Gln Gln Ala Val Arg
        115                 120                 125
Ala Glu Val Ala Ala Arg Ser Ala Arg Ala Val Ala Met Gly Gln Ser
    130                 135                 140
Ala Ser Met Leu Leu Leu Asp Ala Glu Met Gly Thr Leu Ala Gln Arg
145                 150                 155                 160
Gln Gly Asp Leu Arg Arg Gly His Asp Glu Gly Ala Phe Trp Ala Arg
                165                 170                 175
Gly Ser Ala Asn Arg Phe Lys Val Asp Thr Pro Asp Thr Pro Ala Phe
            180                 185                 190
Asp Leu Arg Val Glu Tyr Leu Thr Leu Gly Ala Asp His Gly Trp Arg
        195                 200                 205
Leu Asp Thr Gly Arg Leu Tyr Leu Gly Ala Tyr Ala Gly Val Ser Arg
    210                 215                 220
Ala Arg Met Asp Asp Asn Asp Ile Met His Gly Arg Ile Glu Ser Arg
225                 230                 235                 240
Phe Leu Gly Thr Tyr Leu Thr Tyr Val Asp Asn Gly Gly Phe Tyr Val
                245                 250                 255
Asp Ala Val Ser Lys Leu Gly Arg Ile Asp Glu Ser Val Ser Phe Asp
            260                 265                 270
Leu Pro Leu Gly Leu Gly Asp Tyr Asp Asp Asp Ile Ser His Thr Thr
        275                 280                 285
Tyr Thr Gly Ser Ala Glu Ala Gly Tyr His Phe Lys Leu Pro Gln Arg
    290                 295                 300
Trp Phe Val Glu Pro Gln Ala Gln Val Ile Tyr Ser Arg Ser Ser Gln
305                 310                 315                 320
Thr Ser Val Gln Gly Arg Ala Gly Val Arg Ala Gly Arg Asp Phe Thr
                325                 330                 335
Leu Ala Gly Gly Ala Thr Leu Arg Pro Tyr Val Ser Ala Ser Tyr Leu
            340                 345                 350
His Glu Phe Ser His Asp Asp Ser Val Asp Phe Gly Gly Lys Ser Tyr
        355                 360                 365
Asp Ala Glu Leu Pro Gly Ser Arg Trp Gln Leu Gly Ala Gly Ala Ala
    370                 375                 380
Leu Asp Val Gly Ala His Arg Ala Tyr Ala Asp Leu Arg Tyr Gly His
385                 390                 395                 400
Gly Ala Asn Ile Ser Gln Asp Leu Ser Leu Asn Ile Gly Tyr Ala Tyr
                405                 410                 415
Arg Phe
```

<210> 39
<211> 2712
<212> DNA
<213> Bordetella pertussis

<400> 39

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atggtcggca ggagttgtca tcgtgcaggg tggttatacc gggcgacctt cctcttatac 60
gccgcaaact gtgcttatcc cgcgaacgcc caatcggttt ctggttccgg tcaggtgtcg 120
aacgggccga tcacgtcacc gcactgggtg gtgggcgggg aactgatcgt cggggatacg 180
ggcgccggga ccttgctcat cgaggccggc ggtaccgtgc tcaacgactg ggcctatatc 240
ggcagtgaca atggcgctgt gggcaccctg acggtgtcgg gccgcgacgg cgccggggcc 300
gcgtcgacct ggacgactgt cgacgatgtg tcgatcggcg ttgcggcggg cagcaggggc 360
acgctcgagg tgctcggcgg ggccagggcg caaagcggat ggggcaccat cggcgtcgct 420
gcaggcagcg tcggaagcgt gaccgtgtcc gggcccgggt cggtgtggaa tatcgccacg 480
gtcaattcgt tccagatcgg ctcgggcggc agcgggacgc tgtggatcga ccagggcggc 540
gcagtgtata gcgggcaggg cgtcatcggt tggaaccccg gcagcgacgg gcacgtcacg 600
gtattgggtc cggcaacggt atggaacccg ctgaacaata tctatgtcgg tctcggcggg 660
actggtgaac tggatatccg ggacggcgcg gccgttgcga ctgcagggtc gagcccgccg 720
ggcgccgcgg catcgatcta catcgggacg agcgcaggga gcgccggcac ggtaacggtg 780
tcgagcgcga cggccgtcac ctcgacgctc acgtcgaccg accgtatcga aatcggctcg 840
gccggcgccg gggtgctgac tgtcgccaaa ggcgggatgg tgggcgtcgc cagcgacgcc 900
tggatagcca tcaccggcac gtcctccgga acgctgaacc tgaccggcga tgccagcggc 960
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tatgccaaca cgctgctgca tctgagccgg ctttccacct tgcgccaacg ggtcggcaat 1860
cgcctttatg atccggcaga tgtcggccgc aacggcgtat ggagccgcgt cgagggctcc 1920
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ggcaaggcct tcggattgcg ggaggggctg gccctgatcc cgcaggcgca attgtcgtac 2340
gcatcgaccc gcttcgacag cttcgacgac agattcggcg cccgcgtcga agacgataag 2400
ggcgacagcc tgcagggccg tctcggcatc gcgctggact acaagagcag ctggcaagcg 2460
ggcggcgcga accgggagtc gagtgtcttc ggcatcgtca atgtgaagca tgagttcctg 2520
gatggcacgc gcgtgcgcgt tgccggcgtg ccggtaagca gccgcatggc gcgcacctgg 2580
ggcagcgtgg gagtgggggc cgattacggt tggggagaac gctacgccat ttacggccag 2640
gtggacgccg atgcagattt cgccggcagc tacatcgtca ccgcgaccgc ggggttcagg 2700
atgatgttct ag                                                      2712
```

<210> 40
<211> 903
<212> PRT
<213> Bordetella pertussis

<400> 40

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Met Val Gly Arg Ser Cys His Arg Ala Gly Trp Leu Tyr Arg Ala Thr
 1               5                  10                  15
Phe Leu Leu Tyr Ala Ala Asn Cys Ala Tyr Pro Ala Asn Ala Gln Ser
            20                  25                  30
Val Ser Gly Ser Gly Gln Val Ser Asn Gly Pro Ile Thr Ser Pro His
        35                  40                  45
Trp Val Val Gly Gly Glu Leu Ile Val Gly Asp Thr Gly Ala Gly Thr
    50                  55                  60
```

```
Leu Leu Ile Glu Ala Gly Gly Thr Val Leu Asn Asp Trp Ala Tyr Ile
65                  70                  75                  80
Gly Ser Asp Asn Gly Ala Val Gly Thr Leu Thr Val Ser Gly Arg Asp
                85                  90                  95
Gly Ala Gly Ala Ala Ser Thr Trp Thr Thr Val Asp Asp Val Ser Ile
            100                 105                 110
Gly Val Ala Ala Gly Ser Arg Gly Thr Leu Glu Val Leu Gly Gly Ala
        115                 120                 125
Arg Ala Gln Ser Gly Trp Gly Thr Ile Gly Val Ala Ala Gly Ser Val
    130                 135                 140
Gly Ser Val Thr Val Ser Gly Pro Gly Ser Val Trp Asn Ile Ala Thr
145                 150                 155                 160
Val Asn Ser Phe Gln Ile Gly Ser Gly Gly Ser Gly Thr Leu Trp Ile
                165                 170                 175
Asp Gln Gly Gly Ala Val Tyr Ser Gly Gln Gly Val Ile Gly Trp Asn
            180                 185                 190
Pro Gly Ser Asp Gly His Val Thr Val Leu Gly Pro Ala Thr Val Trp
        195                 200                 205
Asn Pro Leu Asn Asn Ile Tyr Val Gly Leu Gly Gly Thr Gly Glu Leu
    210                 215                 220
Asp Ile Arg Asp Gly Ala Ala Val Ala Thr Ala Gly Ser Ser Pro Pro
225                 230                 235                 240
Gly Ala Ala Ala Ser Ile Tyr Ile Gly Thr Ser Ala Gly Ser Ala Gly
                245                 250                 255
Thr Val Thr Val Ser Ser Ala Thr Ala Val Thr Ser Thr Leu Thr Ser
            260                 265                 270
Thr Asp Arg Ile Glu Ile Gly Ser Ala Gly Ala Gly Val Leu Thr Val
        275                 280                 285
Ala Lys Gly Gly Met Val Gly Val Ala Ser Asp Ala Trp Ile Ala Ile
    290                 295                 300
Thr Gly Thr Ser Ser Gly Thr Leu Asn Leu Thr Gly Asp Ala Ser Gly
305                 310                 315                 320
Arg Gly Val Leu Glu Thr Gly Ser Val Ile Lys Gly Ala Gly Asn Ala
                325                 330                 335
Thr Phe Asn Leu Asp Gly Gly Val Leu Arg Ala Asn Arg Asp Glu Ala
            340                 345                 350
Asn Phe Leu Asn Gly Phe Ser Thr Gln Ala Val Gly Ser Gly Gly Ala
        355                 360                 365
Trp Phe Asp Thr Asn Ala His Asp Val Gly Val Val Thr Ala Phe Ser
    370                 375                 380
Gly Thr Ser Ser Phe Asn Lys Leu Gly Ala Gly Thr Leu Thr Leu Ser
385                 390                 395                 400
Gly Asn Ser Ala Ala Phe Thr Gly Asn Thr Asp Ile Gln Ala Gly Thr
                405                 410                 415
Leu Gln Val Asp Gly Val Leu Gly Gly Pro Val Asp Val Leu Ala Gly
            420                 425                 430
Ala Arg Leu Thr Gly Thr Gly Arg Val Gly Ala Thr Ala Asn Lys Gly
        435                 440                 445
Thr Ile Ala Pro Gly Pro Arg Ser Gly Phe Gly Thr Leu Thr Ile Ala
    450                 455                 460
Gly Asp Tyr Ala Ala Gln Gly Gly Asn Leu Glu Ile Arg Thr Gln Leu
465                 470                 475                 480
Gly Ala Asp Asp Ser Pro Thr Asp Arg Leu Val Ile Thr Gly Ala Ser
                485                 490                 495
Ala Gly Val Thr Pro Val Thr Val Glu Asn Ile Gly Gly Thr Gly Ala
            500                 505                 510
Ser Thr Gln Arg Gly Ile Gln Val Val Gln Val Asn Gly Ala Ser Ala
        515                 520                 525
Gly Arg Phe Asn Leu Ala Asn Gly Asp Tyr Val Ile Glu Gly Arg Pro
    530                 535                 540
Ala Leu Val Ala Gly Ala Tyr Gly Tyr Val Leu Gln Gln Asp Ala Ala
```

```
545                 550                 555                 560
Asp Gly Asp Trp Tyr Leu Lys Ser Ser Leu Pro Asp Pro Gly Ala Pro
                565                 570                 575
Gln Gly Gly Gly Gly Leu Pro Gly Ala Gly Glu Pro Val Leu Tyr Gln
            580                 585                 590
Pro Gly Val Pro Val Tyr Glu Ala Tyr Ala Asn Thr Leu Leu His Leu
        595                 600                 605
Ser Arg Leu Ser Thr Leu Arg Gln Arg Val Gly Asn Arg Leu Tyr Asp
    610                 615                 620
Pro Ala Asp Val Gly Arg Asn Gly Val Trp Ser Arg Val Glu Gly Ser
625                 630                 635                 640
Ala Ser Gln Leu Asp Pro Ser Ala Ser Thr Thr Gly Glu Arg Gln Asp
                645                 650                 655
Val Asp Ser Trp Lys Val Gln Phe Gly Val Asp Arg Ile Leu Ala Gly
            660                 665                 670
Gly Gln Glu Gly Ser Arg Leu Val Gly Gly Leu Ala Leu Gln Tyr Gly
        675                 680                 685
Lys Ala Asp Thr Arg Val Ser Ser Ile Tyr Gly Asn Gly Thr Val Asp
    690                 695                 700
Ala Thr Ala Tyr Gly Leu Thr Pro Thr Leu Thr Trp Tyr Gly Arg Asp
705                 710                 715                 720
Gly Ala Tyr Val Asp Ala Gln Ala Gln Ala Ile Trp Phe Asp Ser Asp
                725                 730                 735
Leu Ser Ser Arg Leu Ala Gly Lys Leu Lys Asp Gly Arg Lys Ala His
            740                 745                 750
Gly Tyr Gly Leu Gly Ile Glu Ala Gly Lys Ala Phe Gly Leu Arg Glu
        755                 760                 765
Gly Leu Ala Leu Ile Pro Gln Ala Gln Leu Ser Tyr Ala Ser Thr Arg
    770                 775                 780
Phe Asp Ser Phe Asp Asp Arg Phe Gly Ala Arg Val Glu Asp Asp Lys
785                 790                 795                 800
Gly Asp Ser Leu Gln Gly Arg Leu Gly Ile Ala Leu Asp Tyr Lys Ser
                805                 810                 815
Ser Trp Gln Ala Gly Gly Ala Asn Arg Glu Ser Ser Val Phe Gly Ile
            820                 825                 830
Val Asn Val Lys His Glu Phe Leu Asp Gly Thr Arg Val Arg Val Ala
        835                 840                 845
Gly Val Pro Val Ser Ser Arg Met Ala Arg Thr Trp Gly Ser Val Gly
    850                 855                 860
Val Gly Ala Asp Tyr Gly Trp Gly Glu Arg Tyr Ala Ile Tyr Gly Gln
865                 870                 875                 880
Val Asp Ala Asp Ala Asp Phe Ala Gly Ser Tyr Ile Val Thr Ala Thr
                885                 890                 895
Ala Gly Phe Arg Met Met Phe
            900
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<210> 41
<211> 1449

<212> DNA
<213> Bordetella pertussis

<400> 41
atgccgtcac ccgatgcctt gccgcacacg ccgcctgctt caggcggcga tcgcgtgatc 60
agcgggatcc tgcagcagga cctcggcagt tggctggcgc cggatgccgc aaagcgcagc 120
ccctccgagc ctggcaaggc ggccgaaaaa atcggggtaa tgccgaacga ggacctcggc 180
aagtggctgg ttccgggggc gcaaaagaac aatccgcccg agcctggcaa gacgctggac 240
gaaatccgtg cgggtctcga aaaatgggtg gcgcccgggt ccaagccgcc cgtcgaaccg 300
gatccggaca aggcgacgca ggcgtatcgc aaagacctcg ataaatggct ggcgcctccg 360
gccaagtccg gcccgcccga agcgccaccc gtcgtccaac ccgaagcgcc gccgcaagcg 420

```
caacctgagg cgccgcctgt cgtgccgccg ccggccgagc cgccagcagc tcgaccgccg 480
gccgttccgc ccgcgcggcc ggccggcgac gcggtgtacg tgccgggcac gcgcacgctg 540
acgccgacgg ccaacgcggc ggtgggcacg gccagcgccg cgcaaggtct gtggcaggcc 600
gagatgaacg cgttgagcaa gcgcatgggc gagttgcgcc tgacgccggt tgcgggcggc 660
gtatggggcc gcgcttttgg ccggcgccag gacgtcgaca accgcgtgtc gcgcgagttc 720
cgccagacca tcagcggttt cgaactgggc gccgataccg ccttgccggt ggccgacggg 780
cgctggcacg tgggcgcggt ggctggctac accaacggcc gcatcaagtt cgaccggggc 840
ggcacgggcg atgacgacag cgtgcacgtg ggcgcttacg ctacctacat cgaggacggc 900
ggtttctata tggatggcat cgtgcgggtc agccgcattc gccacgcgtt caaggtggac 960
gacgccaagg gccggcgcgt gcgcggccag taccgcggca atggcgtggg cgcgtcgctg 1020
gaactgggca agcgcttcac gtggcccggc gcctggtacg tggagccgca gctggaggtg 1080
gccgccttcc atgcgcaagg ggccgactac accgccagca acggcctgcg catcaaggac 1140
gacggcacga actccatgct gggccgcctg ggcctgcacg tggggcggca gttcgacctg 1200
ggcgatggcc gcgtggtgca gccctacatg aagctgagct gggtgcagga gttcgacggc 1260
aagggcacgg tgcgcaccaa cgacatccgg cacaaggtgc ggctcgatgg cggccgcacc 1320
gaactggccg taggggtggc ttcgcaactg ggcaagcacg gcagcctgtt cggctcgtac 1380
gagtacgcca agggcagccg ccagaccatg ccgtggacct tccacgtcgg ctatcgctac 1440
gcctggtag                                                         1449
```

<210> 42
<211> 482
<212> PRT
<213> Bordetella pertussis

<400> 42

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Met Pro Ser Pro Asp Ala Leu Pro His Thr Pro Pro Ala Ser Gly Gly
 1               5                  10                  15
Asp Arg Val Ile Ser Gly Ile Leu Gln Gln Asp Leu Gly Ser Trp Leu
            20                  25                  30
Ala Pro Asp Ala Ala Lys Arg Ser Pro Ser Glu Pro Gly Lys Ala Ala
        35                  40                  45
Glu Lys Ile Gly Val Met Pro Asn Glu Asp Leu Gly Lys Trp Leu Val
    50                  55                  60
Pro Gly Ala Gln Lys Asn Asn Pro Pro Glu Pro Gly Lys Thr Leu Asp
65                  70                  75                  80
Glu Ile Arg Ala Gly Leu Glu Lys Trp Val Ala Pro Gly Ser Lys Pro
                85                  90                  95
Pro Val Glu Pro Asp Pro Asp Lys Ala Thr Gln Ala Tyr Arg Lys Asp
            100                 105                 110
Leu Asp Lys Trp Leu Ala Pro Pro Ala Lys Ser Gly Pro Pro Glu Ala
        115                 120                 125
Pro Pro Val Val Gln Pro Glu Ala Pro Pro Gln Ala Gln Pro Glu Ala
    130                 135                 140
Pro Pro Val Val Pro Pro Pro Ala Glu Pro Pro Ala Ala Arg Pro Pro
145                 150                 155                 160
Ala Val Pro Pro Ala Arg Pro Ala Gly Asp Ala Val Tyr Val Pro Gly
                165                 170                 175
Thr Arg Thr Leu Thr Pro Thr Ala Asn Ala Ala Val Gly Thr Ala Ser
            180                 185                 190
Ala Ala Gln Gly Leu Trp Gln Ala Glu Met Asn Ala Leu Ser Lys Arg
        195                 200                 205
Met Gly Glu Leu Arg Leu Thr Pro Val Ala Gly Gly Val Trp Gly Arg
    210                 215                 220
Ala Phe Gly Arg Arg Gln Asp Val Asp Asn Arg Val Ser Arg Glu Phe
225                 230                 235                 240
Arg Gln Thr Ile Ser Gly Phe Glu Leu Gly Ala Asp Thr Ala Leu Pro
                245                 250                 255
Val Ala Asp Gly Arg Trp His Val Gly Ala Val Ala Gly Tyr Thr Asn
            260                 265                 270
Gly Arg Ile Lys Phe Asp Arg Gly Gly Thr Gly Asp Asp Asp Ser Val
        275                 280                 285
```

```
His Val Gly Ala Tyr Ala Thr Tyr Ile Glu Asp Gly Gly Phe Tyr Met
    290                 295                 300
Asp Gly Ile Val Arg Val Ser Arg Ile Arg His Ala Phe Lys Val Asp
305                 310                 315                 320
Asp Ala Lys Gly Arg Arg Val Arg Gly Gln Tyr Arg Gly Asn Gly Val
                325                 330                 335
Gly Ala Ser Leu Glu Leu Gly Lys Arg Phe Thr Trp Pro Gly Ala Trp
            340                 345                 350
Tyr Val Glu Pro Gln Leu Glu Val Ala Ala Phe His Ala Gln Gly Ala
        355                 360                 365
Asp Tyr Thr Ala Ser Asn Gly Leu Arg Ile Lys Asp Asp Gly Thr Asn
    370                 375                 380
Ser Met Leu Gly Arg Leu Gly Leu His Val Gly Arg Gln Phe Asp Leu
385                 390                 395                 400
Gly Asp Gly Arg Val Val Gln Pro Tyr Met Lys Leu Ser Trp Val Gln
                405                 410                 415
Glu Phe Asp Gly Lys Gly Thr Val Arg Thr Asn Asp Ile Arg His Lys
            420                 425                 430
Val Arg Leu Asp Gly Gly Arg Thr Glu Leu Ala Val Gly Val Ala Ser
        435                 440                 445
Gln Leu Gly Lys His Gly Ser Leu Phe Gly Ser Tyr Glu Tyr Ala Lys
    450                 455                 460
Gly Ser Arg Gln Thr Met Pro Trp Thr Phe His Val Gly Tyr Arg Tyr
465                 470                 475                 480
Ala Trp
```

<210> 43
<211> 2280
<212> DNA
<213> Bordetella pertussis

<400> 43

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atgtgcgaca cctgcagaga tgatgatggc acctcgcctt cgattcgcgt ccaaggcggg 60
gttgttcagg gcggcatggg tgcaaataac gtcgctgtgg tggcaacagg gtctggaaag 120
gtcgcgatcg agaatgcgga actgctcgga gccagcggca tgtacgccac gttcggcgcg 180
caggtcgata tgaaaggcgg gcgcattctg gcgcacaaca ccaatatcct gggaagccag 240
ggttacgccg atggtcccta tggcggcgtg gtcgtgacag aggacggtca agtcaacctg 300
gagggcgcca aggtcagtgc aactggcctg ggggccgccg gcttgtggtt gctgggcgac 360
aaggacacca gcccgcgagc cagcctgcgc aacaccgacg tccacggaga ggtcgccgcc 420
attgcgctgg ggttcaatgg cgaggcgaac atctcgggcg gcagcttgag cgtagaggat 480
ggggccgtgc tcaccaccct gacgcccgat gcagtcgagt attactacga ctacgccttg 540
tccatggagc atctgccagc tgatgcgccg ttgacgccgg tccgcgtcac gctgtccgat 600
ggcgcgcgcg ccagcggaga aacgttgatc gcgcatggcg ggttgttgcc catgacgctg 660
cgcttgagca gcggggtcga cgcccgcggc gacatcgtca cgctgccgcc ttccgcgccg 720
cccgattccg cggagcaacc ggatgccgag ccggaaccgg atgccgagct ggaaccggac 780
gccgcggcgc agtcggacgc caaggcgaat gcgcgggtca tggcgcaggt agatggcggg 840
gaacctgttg ccgtgccgat cccggccccc tcgcatcccg atgccccgat cgacgtgttc 900
atcgacagcg gtgcccaatg gcggggcatg accaagaccg tcaatgcgtt gcgcatcgag 960
gacggcacct ggaccgtcac cgggtcgtcc acggtgaaca gcctgcacct gcaggcaggc 1020
aaggtggcgt acgcaacgcc tgccgaaagc gacggagaat tcaaacacct gcgggtcaag 1080
accctctcgg gaagcggcct gttcgagatg aacgccagcg ccgacctgag cgatggcgac 1140
ctgctggtcg tgtccgacga ggccagcggg cagcacaagg tgctggtgcg aggagccggc 1200
acggaaccca ccggtgtgga aagcctgacg ctggtcgagc tgcccgaggg cagccagacg 1260
aagttcacgc ttgccaaccg gggcggggtg gtcgacgccg gcgcgttccg ctatcgcctg 1320
acgccggaca acggtgtctg gggcctggaa cggaccagcc agctttcggc cgtcgccaac 1380
gcggccttga ataccggggg cgtgggcgcg gccagcagca tctggtatgc ggaaggcaat 1440
gcgctctcca agcgcctggg cgagttgcgg ctcgatcccg gcgcgggcgg cttctggggg 1500
cgcacgttcg cccagaagca gcagctcgac aacaaggctg gccgacgctt cgaccagaag 1560
gtgtacggtt tcgagctggg ggccgaccat gccatcgcag gacagcaagg gcgctggcac 1620
```

```
gtgggcggcc tgctgggcta tacccgcgca aggcgcagct tcatcgatga cggcgccggg 1680
cataccgaca gcgcgcatat cggggcctac gcggcgtacg tggcggacaa cggcttctat 1740
ttcgattcga ccctgcgcgc cagccgcttc gagaacgact tcacggtaac ggccaccgac 1800
gccgtttccg tacggggcaa gtaccgggcc aatggggtag gcgccacctt ggaggccggc 1860
aaacgtttca cgttgcacga cggctggttc gtcgaacctc agtccgaggt gtcgctgttc 1920
catgccagcg gcggaaccta ccgtgccgcg aacaacctgt cggtcaagga cgaaggcggc 1980
acctccgccg tgctgcgcct gggcttggcg gccgggcgac gcatcgacct gggcaaggac 2040
cgcgtgatcc agccctatgc caccctgagc tggctgcagg aattcaaagg cgtcacgacc 2100
gttcgcacca acgggtacgg gctgcgcacc gacctgagcg gtggccgggc tgaattggcg 2160
ctgggcctgg ccgccgcgtt ggggcgcggc caccagctct acacttcgta cgagtacgcc 2220
aagggcaaca agctgacctt gccttggacg ttccacctgg gctatcgcta cacctggtag 2280
```

<210> 44
<211> 759
<212> PRT
<213> Bordetella pertussis

<400> 44

```
Met Cys Asp Thr Cys Arg Asp Asp Asp Gly Thr Ser Pro Ser Ile Arg
 1               5                  10                  15
Val Gln Gly Gly Val Val Gln Gly Gly Met Gly Ala Asn Asn Val Ala
            20                  25                  30
Val Val Ala Thr Gly Ser Gly Lys Val Ala Ile Glu Asn Ala Glu Leu
        35                  40                  45
Leu Gly Ala Ser Gly Met Tyr Ala Thr Phe Gly Ala Gln Val Asp Met
    50                  55                  60
Lys Gly Gly Arg Ile Leu Ala His Asn Thr Asn Ile Leu Gly Ser Gln
65                  70                  75                  80
Gly Tyr Ala Asp Gly Pro Tyr Gly Gly Val Val Val Thr Glu Asp Gly
                85                  90                  95
Gln Val Asn Leu Glu Gly Ala Lys Val Ser Ala Thr Gly Leu Gly Ala
            100                 105                 110
Ala Gly Leu Trp Leu Leu Gly Asp Lys Asp Thr Ser Pro Arg Ala Ser
        115                 120                 125
Leu Arg Asn Thr Asp Val His Gly Glu Val Ala Ala Ile Ala Leu Gly
    130                 135                 140
Phe Asn Gly Glu Ala Asn Ile Ser Gly Gly Ser Leu Ser Val Glu Asp
145                 150                 155                 160
Gly Ala Val Leu Thr Thr Leu Thr Pro Asp Ala Val Glu Tyr Tyr Tyr
                165                 170                 175
Asp Tyr Ala Leu Ser Met Glu His Leu Pro Ala Asp Ala Pro Leu Thr
            180                 185                 190
Pro Val Arg Val Thr Leu Ser Asp Gly Ala Arg Ala Ser Gly Glu Thr
        195                 200                 205
Leu Ile Ala His Gly Gly Leu Leu Pro Met Thr Leu Arg Leu Ser Ser
    210                 215                 220
Gly Val Asp Ala Arg Gly Asp Ile Val Thr Leu Pro Pro Ser Ala Pro
225                 230                 235                 240
Pro Asp Ser Ala Glu Gln Pro Asp Ala Glu Pro Glu Pro Asp Ala Glu
                245                 250                 255
Leu Glu Pro Asp Ala Ala Ala Gln Ser Asp Ala Lys Ala Asn Ala Arg
            260                 265                 270
Val Met Ala Gln Val Asp Gly Gly Glu Pro Val Ala Val Pro Ile Pro
        275                 280                 285
Ala Pro Ser His Pro Asp Ala Pro Ile Asp Val Phe Ile Asp Ser Gly
    290                 295                 300
Ala Gln Trp Arg Gly Met Thr Lys Thr Val Asn Ala Leu Arg Ile Glu
305                 310                 315                 320
Asp Gly Thr Trp Thr Val Thr Gly Ser Ser Thr Val Asn Ser Leu His
                325                 330                 335
```

```
Leu Gln Ala Gly Lys Val Ala Tyr Ala Thr Pro Ala Glu Ser Asp Gly
            340                 345                 350
Glu Phe Lys His Leu Arg Val Lys Thr Leu Ser Gly Ser Gly Leu Phe
        355                 360                 365
Glu Met Asn Ala Ser Ala Asp Leu Ser Asp Gly Asp Leu Leu Val Val
    370                 375                 380
Ser Asp Glu Ala Ser Gly Gln His Lys Val Leu Val Arg Gly Ala Gly
385                 390                 395                 400
Thr Glu Pro Thr Gly Val Glu Ser Leu Thr Leu Val Glu Leu Pro Glu
                405                 410                 415
Gly Ser Gln Thr Lys Phe Thr Leu Ala Asn Arg Gly Gly Val Val Asp
            420                 425                 430
Ala Gly Ala Phe Arg Tyr Arg Leu Thr Pro Asp Asn Gly Val Trp Gly
        435                 440                 445
Leu Glu Arg Thr Ser Gln Leu Ser Ala Val Ala Asn Ala Ala Leu Asn
    450                 455                 460
Thr Gly Gly Val Gly Ala Ala Ser Ser Ile Trp Tyr Ala Glu Gly Asn
465                 470                 475                 480
Ala Leu Ser Lys Arg Leu Gly Glu Leu Arg Leu Asp Pro Gly Ala Gly
                485                 490                 495
Gly Phe Trp Gly Arg Thr Phe Ala Gln Lys Gln Gln Leu Asp Asn Lys
            500                 505                 510
Ala Gly Arg Arg Phe Asp Gln Lys Val Tyr Gly Phe Glu Leu Gly Ala
        515                 520                 525
Asp His Ala Ile Ala Gly Gln Gln Gly Arg Trp His Val Gly Gly Leu
    530                 535                 540
Leu Gly Tyr Thr Arg Ala Arg Arg Ser Phe Ile Asp Asp Gly Ala Gly
545                 550                 555                 560
His Thr Asp Ser Ala His Ile Gly Ala Tyr Ala Ala Tyr Val Ala Asp
                565                 570                 575
Asn Gly Phe Tyr Phe Asp Ser Thr Leu Arg Ala Ser Arg Phe Glu Asn
            580                 585                 590
Asp Phe Thr Val Thr Ala Thr Asp Ala Val Ser Val Arg Gly Lys Tyr
        595                 600                 605
Arg Ala Asn Gly Val Gly Ala Thr Leu Glu Ala Gly Lys Arg Phe Thr
    610                 615                 620
Leu His Asp Gly Trp Phe Val Glu Pro Gln Ser Glu Val Ser Leu Phe
625                 630                 635                 640
His Ala Ser Gly Gly Thr Tyr Arg Ala Ala Asn Asn Leu Ser Val Lys
                645                 650                 655
Asp Glu Gly Gly Thr Ser Ala Val Leu Arg Leu Gly Leu Ala Ala Gly
            660                 665                 670
Arg Arg Ile Asp Leu Gly Lys Asp Arg Val Ile Gln Pro Tyr Ala Thr
        675                 680                 685
Leu Ser Trp Leu Gln Glu Phe Lys Gly Val Thr Thr Val Arg Thr Asn
    690                 695                 700
Gly Tyr Gly Leu Arg Thr Asp Leu Ser Gly Gly Arg Ala Glu Leu Ala
705                 710                 715                 720
Leu Gly Leu Ala Ala Ala Leu Gly Arg Gly His Gln Leu Tyr Thr Ser
                725                 730                 735
Tyr Glu Tyr Ala Lys Gly Asn Lys Leu Thr Leu Pro Trp Thr Phe His
            740                 745                 750
Leu Gly Tyr Arg Tyr Thr Trp
        755
```

<210> 45
<211> 1548
<212> DNA
<213> Bordetella pertussis

<400> 45
ttgcgccaga ccacgccggt gccggtgcgg ctcgtcctgc gcggcgcggc ggtcgcgcag 60
ggcgatgtcg tgcgcgcgcc cgagacggcg ccggagaagg atgggttcgg cacgcccgtg 120
cggccgggct tgcgcgtcgg gctggaccag gcgccgctcg agctcgatgt ggccgacggc 180
gcgcagtggc atggcgcgac tcagtcgctt gacaggctgg ccctgggcgc gggcggccaa 240
tggcgcatga gcgcggcatc cagcgtgggc gaactgagca tggagcctgg cgcggccgtc 300
gtgttcggcg atgcggccgg accgggtttt caaacgctga cggtgcgcac cctggcgggc 360
gccggttcgt tcgagatgcg tgcggacgcc gcgctggagc atgccgatca actggtggtg 420
accgaccagg ccgaagggcg gcatcgcgtg tggttgcgcg cgccggccgg cgccgagccg 480
tcgaaggcac aggccgtgct ggtgcgcgcg cccgcagacg gcaaggccag tttcgaactc 540
gacggcagcg acggcagggc cgacttcggc acctatcgct acgggctggc gcagcagccg 600
ggcggcgcct ggggcctagt caggacgggg tattcgtcca ccgccgccgc ggcgctggat 660
accggcggac tgggcgcggt gcaggggttg tggtatgccg aatccaacgc gttgggcaag 720
cgcatgggcg aattgcgcct gaacccggac gccggcggcg cctggggccg ggcgttcagc 780
cagcgccagc gcatcagtcc gcgcgcgggc cggcatttcc agcaaggcgt cagcggcatc 840
gagctgggcg ccgaccgggc ctggcccgtg gccggcggcc gttggcatgc gggctggttg 900
ctgggctaca cgcgcgcgtc acgcgggttt tccggccagg gaaaggggca caccgacagc 960
gtgcacgtgg gcggctatgc cacctatatc ggcgccaatg gcgtgtacgc cgatgccacg 1020
ctgcgcgcca gccgcttcga gaattcgttc gacgcacctg gctgggcggg gcgcaccgtg 1080
tccggcagct accgcgccaa tggcgtgggc gtgacgctgg aggccggccg gcgtctggcg 1140
ctggaccggc actggttcgt cgagccgcag gccgaactgg cgtggtttcg tgccggcggc 1200
ggtacgtaca cggccagcaa tggcctgcgt atcgaggatg acggcggcac gtcgctgcag 1260
gcgcgggtag gcgcgcaagc cggccgccgc ttcgacttgc gcggcggcgc ggtggtgcag 1320
ccctacgcgc agctgagttg ggtgcaggaa ctcaagggcg tgagcacggt gcgcaccaac 1380
ggcatcgcgc accgtaccga cctgggcgcg ggccgcgtcg aactgggact gggcgtggcg 1440
gccgcgctgg gcaagggcca caatctgtac gcgtcgtacg agtacgcgca cgggcccagg 1500
ctcagcctgc cgtggaccgt gcagctgggt taccgctacg cttggtaa 1548

<210> 46
<211> 515
<212> PRT
<213> Bordetella pertussis

<400> 46
Leu Arg Gln Thr Thr Pro Val Pro Val Arg Leu Val Leu Arg Gly Ala
 1   5   10   15
Ala Val Ala Gln Gly Asp Val Val Arg Ala Pro Glu Thr Ala Pro Glu
            20   25   30
Lys Asp Gly Phe Gly Thr Pro Val Arg Pro Gly Leu Arg Val Gly Leu
        35   40   45
Asp Gln Ala Pro Leu Glu Leu Asp Val Ala Asp Gly Ala Gln Trp His
    50   55   60
Gly Ala Thr Gln Ser Leu Asp Arg Leu Ala Leu Gly Ala Gly Gly Gln
65   70   75   80
Trp Arg Met Ser Ala Ala Ser Ser Val Gly Glu Leu Ser Met Glu Pro
                85   90   95
Gly Ala Ala Val Val Phe Gly Asp Ala Ala Gly Pro Gly Phe Gln Thr
            100   105   110
Leu Thr Val Arg Thr Leu Ala Gly Ala Gly Ser Phe Glu Met Arg Ala
        115   120   125
Asp Ala Ala Leu Glu His Ala Asp Gln Leu Val Val Thr Asp Gln Ala
    130   135   140
Glu Gly Arg His Arg Val Trp Leu Arg Ala Pro Ala Gly Ala Glu Pro
145   150   155   160
Ser Lys Ala Gln Ala Val Leu Val Arg Ala Pro Ala Asp Gly Lys Ala
                165   170   175
Ser Phe Glu Leu Asp Gly Ser Asp Gly Arg Ala Asp Phe Gly Thr Tyr
            180   185   190
Arg Tyr Gly Leu Ala Gln Gln Pro Gly Gly Ala Trp Gly Leu Val Arg
        195   200   205
Thr Gly Tyr Ser Ser Thr Ala Ala Ala Ala Leu Asp Thr Gly Gly Leu

```
    210                 215                 220
Gly Ala Val Gln Gly Leu Trp Tyr Ala Glu Ser Asn Ala Leu Gly Lys
225                 230                 235                 240
Arg Met Gly Glu Leu Arg Leu Asn Pro Asp Ala Gly Gly Ala Trp Gly
                245                 250                 255
Arg Ala Phe Ser Gln Arg Gln Arg Ile Ser Pro Arg Ala Gly Arg His
            260                 265                 270
Phe Gln Gln Gly Val Ser Gly Ile Glu Leu Gly Ala Asp Arg Ala Trp
        275                 280                 285
Pro Val Ala Gly Gly Arg Trp His Ala Gly Trp Leu Leu Gly Tyr Thr
    290                 295                 300
Arg Ala Ser Arg Gly Phe Ser Gly Gln Gly Lys Gly His Thr Asp Ser
305                 310                 315                 320
Val His Val Gly Gly Tyr Ala Thr Tyr Ile Gly Ala Asn Gly Val Tyr
                325                 330                 335
Ala Asp Ala Thr Leu Arg Ala Ser Arg Phe Glu Asn Ser Phe Asp Ala
            340                 345                 350
Pro Gly Trp Ala Gly Arg Thr Val Ser Gly Ser Tyr Arg Ala Asn Gly
        355                 360                 365
Val Gly Val Thr Leu Glu Ala Gly Arg Arg Leu Ala Leu Asp Arg His
    370                 375                 380
Trp Phe Val Glu Pro Gln Ala Glu Leu Ala Trp Phe Arg Ala Gly Gly
385                 390                 395                 400
Gly Thr Tyr Thr Ala Ser Asn Gly Leu Arg Ile Glu Asp Asp Gly Gly
                405                 410                 415
Thr Ser Leu Gln Ala Arg Val Gly Ala Gln Ala Gly Arg Arg Phe Asp
            420                 425                 430
Leu Arg Gly Gly Ala Val Val Gln Pro Tyr Ala Gln Leu Ser Trp Val
        435                 440                 445
Gln Glu Leu Lys Gly Val Ser Thr Val Arg Thr Asn Gly Ile Ala His
    450                 455                 460
Arg Thr Asp Leu Gly Ala Gly Arg Val Glu Leu Gly Leu Gly Val Ala
465                 470                 475                 480
Ala Ala Leu Gly Lys Gly His Asn Leu Tyr Ala Ser Tyr Glu Tyr Ala
                485                 490                 495
His Gly Pro Arg Leu Ser Leu Pro Trp Thr Val Gln Leu Gly Tyr Arg
            500                 505                 510
Tyr Ala Trp
        515
```

<210> 47
<211> 1194
<212> DNA
<213> Bordetella pertussis

<400> 47

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ttgccttcgc cgcccgaaga ggcgcctcag gcggggcccg acgcgtccaa gcagcggccg 60
gagggcctgc ccgcgcccga tgccaatccc caacccgatg caaagcccgg agctgagatg 120
aaaccccggc ctggggtgga acccggacct gaggcggaac ctggtccgca ggggcagcct 180
ggcccccagc ctggagcccg gccgcaggac gagccgcacg cgcagccgct gccgcccgcc 240
ggcaaccccg gcgctgggat ttacatgccc cgcagcggca tcttgaccgc accggttctg 300
gccgtgctgg gcacggccag tgcgccgcaa ggtatctggc aggcagagat gaacgccctg 360
agcaagcgca tgggtgaatt gcggcttacg ccggcagccg gcggcgtgtg ggcacgctcg 420
ttcgcgcaac gccaacgcct ggacaatcag gtggtggaca ggttcaccca gaccgtgggc 480
gggatcgaga ttggcgccga cacggccttg ccggcggccg aggggcgctg gcatgtaggc 540
gcggtggccg gctacagccg tgcgcgccgc aagctggcgc acagcgcccg tggcaacagc 600
gacagcctgc atgtgggcgc ctatgcgacg tatatcggcg acggcggctt ctacctcgac 660
gggattgtgc gggtgaaccg ctacgagcac gatttcaggg ctgacggcca gcgcggcgcg 720
cgcgtgacgg gcaagtatcg cgccaatggc atcgggctgt cgctggagac cggcaggcgt 780
ttcacatggg ccggcgactg gttcgtggaa ccgcaggtcg aagtggcgtt gttccgttcg 840
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ggcggggcag actacacggc cagcaatggc gtgcgcgtcg acgtggcaag caccaagtcg 900
ttgctgggcc gggcaggcct gcaggtggga cgcaagctgg atctgggcaa cggcaaactg 960
gtgcagccgt acgccaagct gagctggttg caggagttcg atggcgtggg caaggtgcgc 1020
accaacgata tcggccatga cgtcaaactg cggggcgggc gcgccgaact cgacttgggc 1080
gtggccgcgg cgcttggcag gcacagcagc ctgtttgctt cgtacgagta cagcaagggc 1140
agccgcttga ccattccgtg gagctttcac gtcggctatc gatacgcctg gtaa       1194

<210> 48
<211> 397
<212> PRT
<213> Bordetella pertussis

<400> 48
Leu Pro Ser Pro Pro Glu Glu Ala Pro Gln Ala Gly Pro Asp Ala Ser
 1               5                  10                  15
Lys Gln Arg Pro Glu Gly Leu Pro Ala Pro Asp Ala Asn Pro Gln Pro
            20                  25                  30
Asp Ala Lys Pro Gly Ala Glu Met Lys Pro Arg Pro Gly Val Glu Pro
        35                  40                  45
Gly Pro Glu Ala Glu Pro Gly Pro Gln Gly Gln Pro Gly Pro Gln Pro
    50                  55                  60
Gly Ala Arg Pro Gln Asp Glu Pro His Ala Gln Pro Leu Pro Pro Ala
65                  70                  75                  80
Gly Asn Pro Gly Ala Gly Ile Tyr Met Pro Arg Ser Gly Ile Leu Thr
                85                  90                  95
Ala Pro Val Leu Ala Val Leu Gly Thr Ala Ser Ala Pro Gln Gly Ile
            100                 105                 110
Trp Gln Ala Glu Met Asn Ala Leu Ser Lys Arg Met Gly Glu Leu Arg
        115                 120                 125
Leu Thr Pro Ala Ala Gly Gly Val Trp Ala Arg Ser Phe Ala Gln Arg
    130                 135                 140
Gln Arg Leu Asp Asn Gln Val Val Asp Arg Phe Thr Gln Thr Val Gly
145                 150                 155                 160
Gly Ile Glu Ile Gly Ala Asp Thr Ala Leu Pro Ala Ala Glu Gly Arg
                165                 170                 175
Trp His Val Gly Ala Val Ala Gly Tyr Ser Arg Ala Arg Arg Lys Leu
            180                 185                 190
Ala His Ser Ala Arg Gly Asn Ser Asp Ser Leu His Val Gly Ala Tyr
        195                 200                 205
Ala Thr Tyr Ile Gly Asp Gly Gly Phe Tyr Leu Asp Gly Ile Val Arg
    210                 215                 220
Val Asn Arg Tyr Glu His Asp Phe Arg Ala Asp Gly Gln Arg Gly Ala
225                 230                 235                 240
Arg Val Thr Gly Lys Tyr Arg Ala Asn Gly Ile Gly Leu Ser Leu Glu
                245                 250                 255
Thr Gly Arg Arg Phe Thr Trp Ala Gly Asp Trp Phe Val Glu Pro Gln
            260                 265                 270
Val Glu Val Ala Leu Phe Arg Ser Gly Gly Ala Asp Tyr Thr Ala Ser
        275                 280                 285
Asn Gly Val Arg Val Asp Val Ala Ser Thr Lys Ser Leu Leu Gly Arg
    290                 295                 300
Ala Gly Leu Gln Val Gly Arg Lys Leu Asp Leu Gly Asn Gly Lys Leu
305                 310                 315                 320
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Val Gly Gly Leu Thr Leu Arg Gly Ile Pro Val Val Val Ala Gln Gly
1905                1910                1915                1920
Gly Ala Thr Thr Ala Pro Gly Ala Phe Arg Leu Ala Gln Pro Leu Val
                1925                1930                1935
Ala Gly Ala Tyr Glu Tyr Gln Leu Leu Arg Gly Ala Gly Asp Gly Ala
            1940                1945                1950
Ala Ala Gln Ala Gln Asp Trp Tyr Leu Arg Thr Ser Arg Val Glu Arg
        1955                1960                1965
Asp Lys Ala Gly Arg Ile Val Lys Val Val Pro Phe Tyr Arg Pro Glu
    1970                1975                1980
Val Ala Leu Tyr Ala Gly Thr Pro Met Leu Met Arg Met Val Gly Thr
1985                1990                1995                2000
Glu Ala Leu Gly Ser Tyr Arg Glu Arg Ala Gly Gln Pro Gly Ala Ala
                2005                2010                2015
Ala Pro Glu Ala Gly Ala Ala Ala Arg Arg Gly Val Trp Ala Arg Thr
            2020                2025                2030
Phe Gly Arg Arg Phe Glu Arg Ser Ala Gly Ser Glu Ala Ala Pro Ser
        2035                2040                2045
Phe Asn Gly Ser Leu Ala Gly Met Gln Leu Gly Ala Asp Leu Tyr Thr
    2050                2055                2060
Arg Arg Ser Ala Thr Arg His Ala Asp Ala Phe Gly Val Phe Gly Gly
2065                2070                2075                2080
Tyr Ala Thr Ala Arg Gly Asp Val Arg Gly Leu Ala Arg Gly Glu Ile
                2085                2090                2095
Gln Ala Val Gly Thr Ser Thr Leu Arg Ala Ala Gln Leu Gly Ala Tyr
            2100                2105                2110
Trp Thr His Thr Gly Pro Ser Gly Trp Tyr Val Asp Thr Val Leu Ala
        2115                2120                2125
Gly Thr Arg Tyr Lys Gln Gln Thr Ser Ser Ser Ala His Val Gly Ala
    2130                2135                2140
Thr Ser Arg Gly Trp Gly Met Met Ala Ser Val Glu Ala Gly Tyr Pro
2145                2150                2155                2160
Trp Gln Leu Asn Pro Arg Trp Gln Ile Glu Pro Gln Ala Gln Leu Val
                2165                2170                2175
Tyr Gln Gln Leu Gly Ile Ala Asn Gly Ala Asp Arg Val Ser Ser Val
            2180                2185                2190
Ser Tyr Lys Thr Pro Asp Ala Leu Thr Gly Arg Leu Gly Thr Arg Leu
        2195                2200                2205
Ala Gly Gln Tyr Ala Tyr Gly Lys Ala Gln Leu Arg Pro Phe Met Gly
    2210                2215                2220
Val Ser Leu Leu His Asp Phe Thr Gly Ala Asp Thr Val Thr Phe Ala
2225                2230                2235                2240
Gly Val His Ser Val Arg Ala Ser Arg Gln Asn Thr Ala Val Asp Leu
                2245                2250                2255
Lys Ala Gly Val Asp Thr Gln Leu Gly Lys Ser Val Gly Leu Trp Gly
            2260                2265                2270
Gln Val Gly Tyr Gly Lys Ser Val Gly Ser Gly Asp Gly Ser Asp Arg
        2275                2280                2285
Gly Trp Ser Ala Asn Leu Gly Leu Arg Val Ala Tyr
    2290                2295                2300
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<210> 51

<211> 2622
<212> DNA
<213> Bordetella pertussis

<400> 51
atgttgcgaa ctggagcccc gatgcgtagc gcccgccgcc gtaccccagc acgacttgcc 60
ccgttgccgg ccatgctggc cgccgccggc ctgctgcaat ccttgggcgc gacgcccgcg 120
gccgcggcct gtgcgcccac gctggcgcca gccagcgggc agagcgtgca atgcgacggc 180
gccgtggtca accagtcggt cgaggcggcg gccggcagcc agaacgtaac catcacggtg 240
gcgcccggcg cgctgttctc gaccaacgcg acgcgggcgc tgtcggtcga tgaccgcagc 300
cgtatcgtca acgagggcac gatccagatg gccggcggcg ccggcgcctc gcgcggcgcc 360
atggtgggtt tcggcgacaa caaccagttg atcaaccgcg gatcgatcac gacatcgggc 420
agcggcgtgc gcggcatctc ggtgcccaac gtcggcagta ccgggacgct ggtcgacaac 480
agcggcagca tccgcaccca gggcgccagc gcgcacggca tcgccatcaa cggcccgggc 540
aaccgcgtcc agaacagcgg cgccatcacc gtcaacggca ccgacgccaa gggcgtgtat 600
ctgcaaggcg gcagccccgc ggccaacgta ctggtcaacg gcggcaccat ccatgcgcgc 660
ggcgccagca gcaacggcat attcggcccc gacggcgtgc atgtgaacac caccaacgcc 720
aacggctttc atgcccgcgt cgagaacctg cccggcgggc gcatcctcag cgatcactcg 780
tatgcgctgc gcgggcagaa cggcaacgat accttcatca acgccggcta cctgcaaggg 840
cacggcgggg ccggccgcga cacggccgtc tacatgggcc cccagggcac gggcacgctg 900
atcctgcgca ccggctcggc catcgccggc ctggccgacg gcggcggggc ggccagccat 960

gcgtatctgg agggcagcgg cacggtggac aaccggttcg ccaacttccg caccctgacc 1020
atgcgcggcg ccgactggcg ctggacctcg gacgccgcgt tcaccgaaag cgtggacctg 1080
cgcaccggca cattctttct tgccggcacg ctcgccagcc cggccaaccg cctggccgcc 1140
ggcgcggtgc tggccggcac cggcacgctg gccggcgcat tgcgcaacgc cggcgaaatc 1200
cggcccggcc cgaacgacgg cagcggctac ggcgcgctga cggtgcgcgg cgattacacc 1260
ggcgcgggcg gcgcgctgcg cgtcaacacg gtgctggccg gcgacggggc cgcctcggac 1320
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ggcgggcagg gcgcgctgac cgcggccgac ggcatcctgg tggtccaggc catcaatggc 1440
gcaagctcgg acgccggcgc cttctcgctg gccgcccccc tcaacgccgg cgcatacgag 1500
tacaggctgt accgcggcgg cgccacgggc gccgcgccgg acagctggta cctgcgctcg 1560
cgggcctatc tggtcgagga ccaactggcc ggcagccttg ccgaagccga ggcgatcgcc 1620
gacgacatcg gccggcgcac cggcgagcgg ccgagcatcg aggacacgcc gctgtaccgg 1680
cccgaggtgg cgctgtacag cagcattccc atgctggcgc ggcgcatggg cctggcccag 1740
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gtcgcggcct gggcgcgcgc ctatggcggc aacagcaagc aggcgctcga cggcgatgcg 1860
caacccggca tcgacgcccg cctggccggc gtgcaactgg ggcaggacct ctacagcagc 1920
gtgcgcccgg acggcggaca gcaccgcttc gggctgttcg gcggctatgg ccaggcgcgc 1980
ggcgacaccc acggctcggc cggcggcgag cgcgacgccg ctaccggccg gctgaccatc 2040
gacggctaca gcgtcggcgg ctactggacc tatgtcggcc cgcgcgggtg gtacgtggat 2100
gccgtgctgg ccaacacctg gatggacatc gacaccgact ccaaggccgg gcgcgacgcc 2160
gatacgcgcg gccaggcgtt cacggcttcg ctggaaagtg gctacccgct ggcgctgtcc 2220
gagcgctgga cgctggagcc gcaggcgcag ctcatctacc agcacacgcg cgtcgacggt 2280
ttctcggacg ccgtgtccga ggtgcgcatc cgcgacgaca acgcgctgac cgcccgcctg 2340
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ctgaatttct ggcgcacctt cagcggcgag aacaccgtcg tgctgggcga agacagcatc 2460
gatacccggc gcggcgcgac ctcgctcgaa ctggcggccg gcgccagcgt gacgctggcc 2520
cgcagcctgg ccctctacgg caggctggcc tatgccacca gcatcgacag ccagtatctg 2580
cgcggcgctt cggcgcagct ggggatgcgc tacacctggt aa 2622

<210> 52
<211> 873
<212> PRT
<213> Bordetella pertussis

<400> 52
Met Leu Arg Thr Gly Ala Pro Met Arg Ser Ala Arg Arg Arg Thr Pro
 1   5   10   15
Ala Arg Leu Ala Pro Leu Pro Ala Met Leu Ala Ala Ala Gly Leu Leu
            20   25   30

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Gln Ser Leu Gly Ala Thr Pro Ala Ala Ala Ala Cys Ala Pro Thr Leu
        35                  40                  45
Ala Pro Ala Ser Gly Gln Ser Val Gln Cys Asp Gly Ala Val Val Asn
    50                  55                  60
Gln Ser Val Glu Ala Ala Ala Gly Ser Gln Asn Val Thr Ile Thr Val
65                  70                  75                  80
Ala Pro Gly Ala Leu Phe Ser Thr Asn Ala Thr Arg Ala Leu Ser Val
                85                  90                  95
Asp Asp Arg Ser Arg Ile Val Asn Glu Gly Thr Ile Gln Met Ala Gly
            100                 105                 110
Gly Ala Gly Ala Ser Arg Gly Ala Met Val Gly Phe Gly Asp Asn Asn

        115                 120                 125
Gln Leu Ile Asn Arg Gly Ser Ile Thr Thr Ser Gly Ser Gly Val Arg
    130                 135                 140
Gly Ile Ser Val Pro Asn Val Gly Ser Thr Gly Thr Leu Val Asp Asn
145                 150                 155                 160
Ser Gly Ser Ile Arg Thr Gln Gly Ala Ser Ala His Gly Ile Ala Ile
                165                 170                 175
Asn Gly Pro Gly Asn Arg Val Gln Asn Ser Gly Ala Ile Thr Val Asn
            180                 185                 190
Gly Thr Asp Ala Lys Gly Val Tyr Leu Gln Gly Gly Ser Pro Ala Ala
        195                 200                 205
Asn Val Leu Val Asn Gly Gly Thr Ile His Ala Arg Gly Ala Ser Ser
    210                 215                 220
Asn Gly Ile Phe Gly Pro Asp Gly Val His Val Asn Thr Thr Asn Ala
225                 230                 235                 240
Asn Gly Phe His Ala Arg Val Glu Asn Leu Pro Gly Gly Arg Ile Leu
                245                 250                 255
Ser Asp His Ser Tyr Ala Leu Arg Gly Gln Asn Gly Asn Asp Thr Phe
            260                 265                 270
Ile Asn Ala Gly Tyr Leu Gln Gly His Gly Gly Ala Gly Arg Asp Thr
        275                 280                 285
Ala Val Tyr Met Gly Pro Gln Gly Thr Gly Thr Leu Ile Leu Arg Thr
    290                 295                 300
Gly Ser Ala Ile Ala Gly Leu Ala Asp Gly Gly Gly Ala Ala Ser His
305                 310                 315                 320
Ala Tyr Leu Glu Gly Ser Gly Thr Val Asp Asn Arg Phe Ala Asn Phe
                325                 330                 335
Arg Thr Leu Thr Met Arg Gly Ala Asp Trp Arg Trp Thr Ser Asp Ala
            340                 345                 350
Ala Phe Thr Glu Ser Val Asp Leu Arg Thr Gly Thr Phe Phe Leu Ala
        355                 360                 365
Gly Thr Leu Ala Ser Pro Ala Asn Arg Leu Ala Ala Gly Ala Val Leu
    370                 375                 380
Ala Gly Thr Gly Thr Leu Ala Gly Ala Leu Arg Asn Ala Gly Glu Ile
385                 390                 395                 400
Arg Pro Gly Pro Asn Asp Gly Ser Gly Tyr Gly Ala Leu Thr Val Arg
                405                 410                 415
Gly Asp Tyr Thr Gly Ala Gly Gly Ala Leu Arg Val Asn Thr Val Leu
            420                 425                 430
Ala Gly Asp Gly Ala Ala Ser Asp Arg Leu Val Ile Asp Gly Gly His
        435                 440                 445
Ala Gly Gly Ser Thr Pro Val Thr Val Val Asn Arg Gly Gly Gln Gly
    450                 455                 460
Ala Leu Thr Ala Ala Asp Gly Ile Leu Val Val Gln Ala Ile Asn Gly
465                 470                 475                 480
Ala Ser Ser Asp Ala Gly Ala Phe Ser Leu Ala Ala Pro Leu Asn Ala
                485                 490                 495
Gly Ala Tyr Glu Tyr Arg Leu Tyr Arg Gly Gly Ala Thr Gly Ala Ala
            500                 505                 510
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Pro Asp Ser Trp Tyr Leu Arg Ser Arg Ala Tyr Leu Val Glu Asp Gln
        515                 520                 525
Leu Ala Gly Ser Leu Ala Glu Ala Glu Ala Ile Ala Asp Asp Ile Gly
    530                 535                 540
Arg Arg Thr Gly Glu Arg Pro Ser Ile Glu Asp Thr Pro Leu Tyr Arg
545                 550                 555                 560
Pro Glu Val Ala Leu Tyr Ser Ser Ile Pro Met Leu Ala Arg Arg Met
                565                 570                 575
Gly Leu Ala Gln Leu Gly Thr Phe His Glu Arg Gln Gly Asn Gln Ala
            580                 585                 590
Leu Leu Ala Arg Asp Gly Glu Arg Val Ala Ala Trp Ala Arg Ala Tyr
        595                 600                 605
Gly Gly Asn Ser Lys Gln Ala Leu Asp Gly Asp Ala Gln Pro Gly Ile
    610                 615                 620
Asp Ala Arg Leu Ala Gly Val Gln Leu Gly Gln Asp Leu Tyr Ser Ser
625                 630                 635                 640
Val Arg Pro Asp Gly Gly Gln His Arg Phe Gly Leu Phe Gly Gly Tyr
                645                 650                 655
Gly Gln Ala Arg Gly Asp Thr His Gly Ser Ala Gly Gly Glu Arg Asp
            660                 665                 670
Ala Ala Thr Gly Arg Leu Thr Ile Asp Gly Tyr Ser Val Gly Gly Tyr
        675                 680                 685
Trp Thr Tyr Val Gly Pro Arg Gly Trp Tyr Val Asp Ala Val Leu Ala
    690                 695                 700
Asn Thr Trp Met Asp Ile Asp Thr Asp Ser Lys Ala Gly Arg Asp Ala
705                 710                 715                 720
Asp Thr Arg Gly Gln Ala Phe Thr Ala Ser Leu Glu Ser Gly Tyr Pro
                725                 730                 735
Leu Ala Leu Ser Glu Arg Trp Thr Leu Glu Pro Gln Ala Gln Leu Ile
            740                 745                 750
Tyr Gln His Thr Arg Val Asp Gly Phe Ser Asp Ala Val Ser Glu Val
        755                 760                 765
Arg Ile Arg Asp Asp Asn Ala Leu Thr Ala Arg Leu Gly Ala Arg Leu
    770                 775                 780
Gln Gly Glu Tyr Ala Ala Ala Ala Gln Val Trp Arg Pro Tyr Ala Ala
785                 790                 795                 800
Leu Asn Phe Trp Arg Thr Phe Ser Gly Glu Asn Thr Val Val Leu Gly
                805                 810                 815
Glu Asp Ser Ile Asp Thr Arg Arg Gly Ala Thr Ser Leu Glu Leu Ala
            820                 825                 830
Ala Gly Ala Ser Val Thr Leu Ala Arg Ser Leu Ala Leu Tyr Gly Arg
        835                 840                 845
Leu Ala Tyr Ala Thr Ser Ile Asp Ser Gln Tyr Leu Arg Gly Ala Ser
    850                 855                 860
Ala Gln Leu Gly Met Arg Tyr Thr Trp
865                 870
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<210> 53
<211> 3120
<212> DNA
<213> Bordetella pertussis

<400> 53
atgcctgctc aacgcactcc tcgcaccgcg gtttgtgagg ccaccgtccg ttcatcgcca 60
cgttggatcc attgcaccgg attcgtgctg tgcgcgctgc tggcggcatg cggaggcggt 120
ggcggcggag gtggcggcgg aggcggtggc ggcagcccgg gcggccgtgc gccatcggcg 180
ccgcaacccg ccccttcgcc acgccccgaa cctgcacccg agccggcacc caatcctgcg 240
cccaggcctg ctccgcaacc gccggcgccc gcgcctggag cgccccgtcc tcccgcgccg 300
ccaccggagg ctccccccgcc cgtgatgccg ccgccggccg tgccgcctca gctgcccgaa 360
gtgccggccg cagacctgcc ccgcgtgcgc gcgccgctgt cgacataccg gcggccgcaa 420

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cgcaccgact tcgtcacgcc caccggcggg ccgttcttcg ccaagcagga caaagccctc 480
aacaccatcg acctgaagat ggcgcacgac ctgaagctgc ggggctaccg cgtcaaagtc 540
gcggtcgtcg acgaaggcgt gcgcagcgac catccgctcc tgaacgtcga gaagaaatac 600
ggtggcgatt acatggccga cggcacccgc acctaccccg accccaagcg ccagggcagg 660
cacggaacct cggtcgccct ggtactggcc ggacaggaca ccgacacgta tcgcggcggc 720
gttgcgccca atgccgacct ctattcggcc aacatcggca cgcgggccgg ccacgtctcc 780
gacgaagccg cattccacgc ctggaacgac ctgctcgggc acggcatcaa gatcttcaac 840
aacagtttcg ccaccgaagg tccggaaggc gagcagcgcg tcaaggagga ccgcaacgaa 900
taccatagcg ccgccaacaa gcagaacacc tacatcggac ggctcgatcg cctggtgcgc 960
gacggcgcgc tcctcatttt cgccgccggc aacggcaggc catcgggtcg cgcctacagt 1020
gaggtcggct cggtcggacg cacccctcgc gtcgagccgc acctgcaacg cggcctgatc 1080
gtggtcaccg cggtggacga aaacggcagg ctcgaaacat gggccaaccg ctgcgggcaa 1140
gcgcagcaat ggtgcctggc cgcgcccagc accgcctacc tgcccggcct cgacaaggac 1200
aaccccgaca gcatccacgt cgaacagggc acgtcgctat ccgcgccgct ggtcaccggc 1260
gccgccgtac tggtgcagga tcgctttcgc tggatggaca acgacaacct gcgcaccacc 1320
ttgctgacca cggcgcagga caagggcccg tacggcgtcg acccgcagta cggctggggc 1380
gtgctcgacg tgggccgcgc cgtgcagggc ccggcgcagt tcgccttcgg cgacttcgtc 1440
gcccgggtta cggatacctc cacgttcggc aacgacatct ccggcgccgg cgggctggtc 1500
gtcgacggcc ccggcgcgct ggtcctggcc ggctccaata cctatgccgg ccgcaccacc 1560
atcaagcgcg gcaccctcga cgtctttggc agcgtcacgt ccgccgtcac cgtcgagcct 1620
ggcggcacgc tgaccggcat cggcaccgtc ggcacggtga ccaaccaggg cacggtggtc 1680
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catgtggacg acatccgccc cggctacgtc ggcggcgacg ggaaaagcgt cccggtcatc 1860
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aacgcccggc tggactaccg gccccaggcc gtctacctga ccatgcggcg cgccgagcgc 1980
gtccatgccg cggcgcagcg gggcgcggac gacgggcgtc gcgcgtcggt gctggccgtg 2040
gccgagcggc tcgacgccgc gatgcgcgaa ctcgatgccc tgcccgagtc gcagcgcgac 2100
gccgcggcgc cggcggccgc catcggacgc atccagcgcg tgcaaagccg caaggtgctg 2160
caggacaacc tgtattcgct ggccggcgcc acctacgcca acgccgccgc ggtcaacacg 2220
ctggagcaga accgctggat ggaccgcctc gagaaccacc tggcccaggc cggcggcgag 2280
cgcgtggcgg ccatcgccga gtatcgccac ggccagttgc gctggcgccc cgatggcctg 2340
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ctgagcctgg ccgcggcgct gacccacagc cgcacgcact gggacgagtc gtccggcgcg 2460
ccggcccgcg acaacgccgc catgaccacg ccgggcgtac tgctgggcgc gcgccgcgcc 2520
tgggaggacg gctggttcgt gcagggcgca ctgggctata gccgctaccg caaccaggcc 2580
acgcgccaca tctcgctcgg cgatgccggc cacaccgtcg gcgccaccgc ccggggccac 2640
gtctggcagg ccgacgccgg cctgggacgc cagtggacgc tcgcccccgg acacacgctg 2700
gcgcctcggg cgggcctgca actcacgcat ctgcgccagc aaggtttcag cgagagcggc 2760
gcgcaaggac tggggctgcg cgcccacgcc ttgacgcgca ccgtgcccac gctgtgggcg 2820
caactgcaaa gccgccatgc cttcatgctg ggagccacgc ccatgacggc gcagctgcaa 2880
ctgggcgtct ggcatgacct gcgcgcgcgg cgctacgccg cctccggcgg tttcgccggc 2940
ctggcgcagg accagggcgc cagcggctac tggcccgtgc cgcgcacacg cgtacagggc 3000
gcgctcggcc tgcgcgccga gttcgcgcca ggcctcgtgc tggggctggg ctacacgggc 3060
cagcttgcca cgcactgggt cgatcaccag ctcagcgcca gcctcactta ccgctactga 3120
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<210> 54
<211> 1039
<212> PRT
<213> Bordetella pertussis

<400> 54

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Arg Ser Ser Pro Arg Trp Ile His Cys Thr Gly Phe Val Leu Cys Ala
            20                  25                  30
Leu Leu Ala Ala Cys Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
        35                  40                  45
Gly Gly Gly Ser Pro Gly Gly Arg Ala Pro Ser Ala Pro Gln Pro Ala
    50                  55                  60
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Pro Ser Pro Arg Pro Glu Pro Ala Pro Glu Pro Ala Pro Asn Pro Ala
65                  70                  75                  80
Pro Arg Pro Ala Pro Gln Pro Pro Ala Pro Ala Pro Gly Ala Pro Arg
                85                  90                  95
Pro Pro Ala Pro Pro Pro Glu Ala Pro Pro Pro Val Met Pro Pro Pro
            100                 105                 110
Ala Val Pro Pro Gln Leu Pro Glu Val Pro Ala Ala Asp Leu Pro Arg
        115                 120                 125
Val Arg Ala Pro Leu Ser Thr Tyr Arg Arg Pro Gln Arg Thr Asp Phe
    130                 135                 140
Val Thr Pro Thr Gly Gly Pro Phe Phe Ala Lys Gln Asp Lys Ala Leu
145                 150                 155                 160
Asn Thr Ile Asp Leu Lys Met Ala His Asp Leu Lys Leu Arg Gly Tyr
                165                 170                 175
Arg Val Lys Val Ala Val Val Asp Glu Gly Val Arg Ser Asp His Pro
            180                 185                 190
Leu Leu Asn Val Glu Lys Lys Tyr Gly Gly Asp Tyr Met Ala Asp Gly
        195                 200                 205
Thr Arg Thr Tyr Pro Asp Pro Lys Arg Gln Gly Arg His Gly Thr Ser
    210                 215                 220
Val Ala Leu Val Leu Ala Gly Gln Asp Thr Asp Thr Tyr Arg Gly Gly
225                 230                 235                 240
Val Ala Pro Asn Ala Asp Leu Tyr Ser Ala Asn Ile Gly Thr Arg Ala
                245                 250                 255
Gly His Val Ser Asp Glu Ala Ala Phe His Ala Trp Asn Asp Leu Leu
            260                 265                 270
Gly His Gly Ile Lys Ile Phe Asn Asn Ser Phe Ala Thr Glu Gly Pro
        275                 280                 285
Glu Gly Glu Gln Arg Val Lys Glu Asp Arg Asn Glu Tyr His Ser Ala
    290                 295                 300
Ala Asn Lys Gln Asn Thr Tyr Ile Gly Arg Leu Asp Arg Leu Val Arg
305                 310                 315                 320
Asp Gly Ala Leu Leu Ile Phe Ala Ala Gly Asn Gly Arg Pro Ser Gly
                325                 330                 335
Arg Ala Tyr Ser Glu Val Gly Ser Val Gly Arg Thr Pro Arg Val Glu
            340                 345                 350
Pro His Leu Gln Arg Gly Leu Ile Val Val Thr Ala Val Asp Glu Asn
        355                 360                 365
Gly Arg Leu Glu Thr Trp Ala Asn Arg Cys Gly Gln Ala Gln Gln Trp
    370                 375                 380
Cys Leu Ala Ala Pro Ser Thr Ala Tyr Leu Pro Gly Leu Asp Lys Asp
385                 390                 395                 400
Asn Pro Asp Ser Ile His Val Glu Gln Gly Thr Ser Leu Ser Ala Pro
                405                 410                 415
Leu Val Thr Gly Ala Ala Val Leu Val Gln Asp Arg Phe Arg Trp Met
            420                 425                 430
Asp Asn Asp Asn Leu Arg Thr Thr Leu Leu Thr Thr Ala Gln Asp Lys
        435                 440                 445
Gly Pro Tyr Gly Val Asp Pro Gln Tyr Gly Trp Gly Val Leu Asp Val
    450                 455                 460
Gly Arg Ala Val Gln Gly Pro Ala Gln Phe Ala Phe Gly Asp Phe Val
465                 470                 475                 480
Ala Arg Val Thr Asp Thr Ser Thr Phe Gly Asn Asp Ile Ser Gly Ala
                485                 490                 495
Gly Gly Leu Val Val Asp Gly Pro Gly Ala Leu Val Leu Ala Gly Ser
            500                 505                 510
Asn Thr Tyr Ala Gly Arg Thr Thr Ile Lys Arg Gly Thr Leu Asp Val
        515                 520                 525
Phe Gly Ser Val Thr Ser Ala Val Thr Val Glu Pro Gly Gly Thr Leu
    530                 535                 540
Thr Gly Ile Gly Thr Val Gly Thr Val Thr Asn Gln Gly Thr Val Val
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545 550 555 560
Asn Lys Glu Ala Gly Leu His Val Lys Gly Asp Tyr Ser Gln Thr Ala
565 570 575
Gln Gly Leu Leu Val Thr Asp Ile Gly Ser Leu Leu Asp Val Ser Gly
580 585 590
Arg Ala Ser Leu Ala Gly Arg Leu His Val Asp Asp Ile Arg Pro Gly
595 600 605
Tyr Val Gly Gly Asp Gly Lys Ser Val Pro Val Ile Lys Ala Gly Ala
610 615 620
Val Ser Gly Val Phe Ala Thr Leu Thr Arg Ser Pro Gly Leu Leu Leu
625 630 635 640
Asn Ala Arg Leu Asp Tyr Arg Pro Gln Ala Val Tyr Leu Thr Met Arg
645 650 655
Arg Ala Glu Arg Val His Ala Ala Ala Gln Arg Gly Ala Asp Asp Gly
660 665 670
Arg Arg Ala Ser Val Leu Ala Val Ala Glu Arg Leu Asp Ala Ala Met
675 680 685
Arg Glu Leu Asp Ala Leu Pro Glu Ser Gln Arg Asp Ala Ala Ala Pro
690 695 700
Ala Ala Ala Ile Gly Arg Ile Gln Arg Val Gln Ser Arg Lys Val Leu
705 710 715 720
Gln Asp Asn Leu Tyr Ser Leu Ala Gly Ala Thr Tyr Ala Asn Ala Ala
725 730 735
Ala Val Asn Thr Leu Glu Gln Asn Arg Trp Met Asp Arg Leu Glu Asn
740 745 750
His Leu Ala Gln Ala Gly Gly Glu Arg Val Ala Ala Ile Ala Glu Tyr
755 760 765
Arg His Gly Gln Leu Arg Trp Arg Pro Asp Gly Leu Gln Gly Arg Gln
770 775 780
Arg Gly Asn Gly Ile Met Leu Gly Leu Ala Arg Glu Val Ser Ala Gly
785 790 795 800
Leu Ser Leu Ala Ala Ala Leu Thr His Ser Arg Thr His Trp Asp Glu
805 810 815
Ser Ser Gly Ala Pro Ala Arg Asp Asn Ala Ala Met Thr Thr Pro Gly
820 825 830
Val Leu Leu Gly Ala Arg Arg Ala Trp Glu Asp Gly Trp Phe Val Gln
835 840 845
Gly Ala Leu Gly Tyr Ser Arg Tyr Arg Asn Gln Ala Thr Arg His Ile
850 855 860
Ser Leu Gly Asp Ala Gly His Thr Val Gly Ala Thr Ala Arg Gly His
865 870 875 880
Val Trp Gln Ala Asp Ala Gly Leu Gly Arg Gln Trp Thr Leu Ala Pro
885 890 895
Gly His Thr Leu Ala Pro Arg Ala Gly Leu Gln Leu Thr His Leu Arg
900 905 910
Gln Gln Gly Phe Ser Glu Ser Gly Ala Gln Gly Leu Gly Leu Arg Ala
915 920 925
His Ala Leu Thr Arg Thr Val Pro Thr Leu Trp Ala Gln Leu Gln Ser
930 935 940
Arg His Ala Phe Met Leu Gly Ala Thr Pro Met Thr Ala Gln Leu Gln
945 950 955 960
Leu Gly Val Trp His Asp Leu Arg Ala Arg Arg Tyr Ala Ala Ser Gly
965 970 975
Gly Phe Ala Gly Leu Ala Gln Asp Gln Gly Ala Ser Gly Tyr Trp Pro
980 985 990
Val Pro Arg Thr Arg Val Gln Gly Ala Leu Gly Leu Arg Ala Glu Phe
995 1000 1005
Ala Pro Gly Leu Val Leu Gly Leu Gly Tyr Thr Gly Gln Leu Ala Thr
1010 1015 1020

His Trp Val Asp His Gln Leu Ser Ala Ser Leu Thr Tyr Arg Tyr

1025 1030 1035

<210> 55
<211> 2244
<212> DNA
<213> Bordetella pertussis

<400> 55
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cttggttgcg ctgccggcgc atacggcgcg cccgcgccgg cacaaaccgt cgtcaccctg 120
cccgcgcaag aggtcatcgg cgacagcgtc gcggcggccc ggtccgtgct gcgcctgccg 180
gagatcgagc gcgcgcaggc cgacaacttc gcctccctgg tcgatcagct gccgggcatc 240
tcgatggccg gctctccgcg ccccggcggg caaagcctga acatctgggg catgggcgat 300
accgaggacg tgaaaatcgt cctcgatggc gcgcccaagg gtttcgagaa gtaccgccag 360
ggctcggtct tcatcgaacc cgaactgatc cggcgcatcg aggtcgacaa ggggccgcac 420
aacctggtcg acggcaatgg cgggttcggc ggcaccgtca agatcgatac caaggatgcg 480
gccgacctgt tgccgccggg cgcgcgcttc ggcgcgctgg ccaagtacgg ccgccattcg 540
aacgacggcc aggacatcta cagcgtggcg ctgtacggcc gcacccgcgc cgacggggcc 600
gacggcctgc tgtatgccaa ccgccgcgac ggcggcgatc tgcgccgccc cgacggcacc 660
cgcttcgcat actcgcgcaa caaccagcgc tcgctgctcg ccaaggtcaa cctctatccg 720
gacgacgccc agaccatcac cctgtcggcc atgcgttcga atgcggcggg ttggcaaccc 780
ttcgcggcca agcgcgacga tcttcccgcg ccttcgcagg ccgatatcga ccgctacggc 840
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gcgaaatgga acatcgcccc atccgcccat ccctgggtga acctcacgct ggcctatgcc 960
cgctcggaca cccggcagcg cgaccggcgc tcgtcccggg cgtcgcagtc ggcctttctc 1020
ggcacgctgg gcaacaagag ttgggtcgac taccgcgacg accggttcga cctcagcaac 1080
gaaagccacg tggccctggg cacggccgag catgtcctgc tggcgggcct gcgctggcac 1140
cggcatcgcc gcgacacgct catgtactac ccgcccggcc gcggcgagcc cgattacaac 1200
cacgggtact tccagccgca ctacatgcct tcgggcacgc agaccgtgcg cagcctgtac 1260
ctgcaggacg ccgtcaccgt cggcggcctt accgtcacgc ccggcgtgcg gtacgaccat 1320
gtcgccaata ccggcaggcc aaacgacgcg ccccgctaca acaaccccgc ccccgtggcc 1380
gggcatgact accgccgcgt ctcgtacgcg ggctggaccc cgcacctggg cgtggtctgg 1440
aaggcggcgc gaggcgtggc gctgttcgcc gacgccggcc gcacctggcg cgcacccgtc 1500
atcgacgaac agtacgaagt gcaatatgcg aagtccaatg tgtcgggcag cagccgggcg 1560
ctgcggcccg agcgcatcgt gggcctgcgc gccggcgccg tactggatta caacgatatc 1620
gcgacgcgcg gcgacagcgt gcagatacgg accacgctgt ttcgcaatcg cggcaagcac 1680
gagatcttcc agcgccgtgg cgtggcatgc cgcgggcagg ccgagggcgg cgccgcctcg 1740
gactgcccca agcccttgtc caactaccgc aacctgcccg gctacaccat cgaagggctg 1800
gaactggaga cctactacga cagcccggcg atgttcgcca gcctgtcgct ttcggccatg 1860
cgcgggcacc gcgacgcctc gccgcgcgat ccatgggggc cgcgcacctg gatcgccgag 1920
atcccgccgg tctcggcgcg cgcgatgctg ggcgtgaaac tgccgcgcct ggacatggtc 1980
ctgggatggc gcggcgaatt cgtgcgccgc caggaccgct cgccgaccga cggcgacccg 2040
ctggccggct actgggcctt gcccaagacc gccggctacg cgctgcacgg cctgttcgca 2100
agctggcaac cccggcatgt caaaggcctg gacgtgcgcc tggccgccga caacctcttc 2160
aaccggccct atcatcccta cctgggcgaa gcggtatcgg gcacgggccg caacatcaag 2220
ctgagcatcg cccagcgctt ctag 2244

<210> 56
<211> 747
<212> PRT
<213> Bordetella pertussis

<400> 56
Met Ser Ser Pro Arg Pro Pro Ala Pro Trp Arg Ala Pro Leu Ala Leu
1 5 10 15
Ala Gly Leu Ser Leu Gly Cys Ala Ala Gly Ala Tyr Gly Ala Pro Ala
20 25 30
Pro Ala Gln Thr Val Val Thr Leu Pro Ala Gln Glu Val Ile Gly Asp
35 40 45
Ser Val Ala Ala Ala Arg Ser Val Leu Arg Leu Pro Glu Ile Glu Arg

```
    50                  55                  60
Ala Gln Ala Asp Asn Phe Ala Ser Leu Val Asp Gln Leu Pro Gly Ile
65                  70                  75                  80
Ser Met Ala Gly Ser Pro Arg Pro Gly Gly Gln Ser Leu Asn Ile Trp
                85                  90                  95
Gly Met Gly Asp Thr Glu Asp Val Lys Ile Val Leu Asp Gly Ala Pro
            100                 105                 110
Lys Gly Phe Glu Lys Tyr Arg Gln Gly Ser Val Phe Ile Glu Pro Glu
        115                 120                 125
Leu Ile Arg Arg Ile Glu Val Asp Lys Gly Pro His Asn Leu Val Asp
    130                 135                 140
Gly Asn Gly Gly Phe Gly Gly Thr Val Lys Ile Asp Thr Lys Asp Ala
145                 150                 155                 160
Ala Asp Leu Leu Pro Pro Gly Ala Arg Phe Gly Ala Leu Ala Lys Tyr
                165                 170                 175
Gly Arg His Ser Asn Asp Gly Gln Asp Ile Tyr Ser Val Ala Leu Tyr
            180                 185                 190
Gly Arg Thr Arg Ala Asp Gly Ala Asp Gly Leu Leu Tyr Ala Asn Arg
        195                 200                 205
Arg Asp Gly Gly Asp Leu Arg Arg Pro Asp Gly Thr Arg Phe Ala Tyr
    210                 215                 220
Ser Arg Asn Asn Gln Arg Ser Leu Leu Ala Lys Val Asn Leu Tyr Pro
225                 230                 235                 240
Asp Asp Ala Gln Thr Ile Thr Leu Ser Ala Met Arg Ser Asn Ala Ala
                245                 250                 255
Gly Trp Gln Pro Phe Ala Ala Lys Arg Asp Asp Leu Pro Ala Pro Ser
            260                 265                 270
Gln Ala Asp Ile Asp Arg Tyr Gly Leu Thr Glu Ala Trp Arg Arg Lys
        275                 280                 285
Leu Val His Arg Asp Gln Leu Asp Gln Asn Tyr Ser Ala Lys Trp Asn
    290                 295                 300
Ile Ala Pro Ser Ala His Pro Trp Val Asn Leu Thr Leu Ala Tyr Ala
305                 310                 315                 320
Arg Ser Asp Thr Arg Gln Arg Asp Arg Arg Ser Ser Arg Ala Ser Gln
                325                 330                 335
Ser Ala Phe Leu Gly Thr Leu Gly Asn Lys Ser Trp Val Asp Tyr Arg
            340                 345                 350
Asp Asp Arg Phe Asp Leu Ser Asn Glu Ser His Val Ala Leu Gly Thr
        355                 360                 365
Ala Glu His Val Leu Leu Ala Gly Leu Arg Trp His Arg His Arg Arg
    370                 375                 380
Asp Thr Leu Met Tyr Tyr Pro Pro Gly Arg Gly Glu Pro Asp Tyr Asn
385                 390                 395                 400
His Gly Tyr Phe Gln Pro His Tyr Met Pro Ser Gly Thr Gln Thr Val
                405                 410                 415
Arg Ser Leu Tyr Leu Gln Asp Ala Val Thr Val Gly Gly Leu Thr Val
            420                 425                 430
Thr Pro Gly Val Arg Tyr Asp His Val Ala Asn Thr Gly Arg Pro Asn
        435                 440                 445
Asp Ala Pro Arg Tyr Asn Asn Pro Ala Pro Val Ala Gly His Asp Tyr
    450                 455                 460
Arg Arg Val Ser Tyr Ala Gly Trp Thr Pro His Leu Gly Val Val Trp
465                 470                 475                 480
Lys Ala Ala Arg Gly Val Ala Leu Phe Ala Asp Ala Gly Arg Thr Trp
                485                 490                 495
Arg Ala Pro Val Ile Asp Glu Gln Tyr Glu Val Gln Tyr Ala Lys Ser
            500                 505                 510
Asn Val Ser Gly Ser Ser Arg Ala Leu Arg Pro Glu Arg Ile Val Gly
        515                 520                 525
Leu Arg Ala Gly Ala Val Leu Asp Tyr Asn Asp Ile Ala Thr Arg Gly
    530                 535                 540
```

```
Asp Ser Val Gln Ile Arg Thr Thr Leu Phe Arg Asn Arg Gly Lys His
545                 550                 555                 560
Glu Ile Phe Gln Arg Arg Gly Val Ala Cys Arg Gly Gln Ala Glu Gly
                565                 570                 575
Gly Ala Ala Ser Asp Cys Pro Lys Pro Leu Ser Asn Tyr Arg Asn Leu
            580                 585                 590
Pro Gly Tyr Thr Ile Glu Gly Leu Glu Leu Glu Thr Tyr Tyr Asp Ser
        595                 600                 605
Pro Ala Met Phe Ala Ser Leu Ser Leu Ser Ala Met Arg Gly His Arg
    610                 615                 620
Asp Ala Ser Pro Arg Asp Pro Trp Gly Pro Arg Thr Trp Ile Ala Glu
625                 630                 635                 640
Ile Pro Pro Val Ser Ala Arg Ala Met Leu Gly Val Lys Leu Pro Arg
                645                 650                 655
Leu Asp Met Val Leu Gly Trp Arg Gly Glu Phe Val Arg Arg Gln Asp
            660                 665                 670
Arg Ser Pro Thr Asp Gly Asp Pro Leu Ala Gly Tyr Trp Ala Leu Pro
        675                 680                 685
Lys Thr Ala Gly Tyr Ala Leu His Gly Leu Phe Ala Ser Trp Gln Pro
    690                 695                 700
Arg His Val Lys Gly Leu Asp Val Arg Leu Ala Ala Asp Asn Leu Phe
705                 710                 715                 720
Asn Arg Pro Tyr His Pro Tyr Leu Gly Glu Ala Val Ser Gly Thr Gly
                725                 730                 735
Arg Asn Ile Lys Leu Ser Ile Ala Gln Arg Phe
            740                 745
```

<210> 57
<211> 1578
<212> DNA
<213> Bordetella pertussis

<400> 57

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atgaaggcgc ggcgcctggc catggcgggt ctgtcgctgg cgctcggcgg ctgctcgctg 60
tcgcagcaga tgcaggccat gcgcgacgcc gcgacgtccc tgcgcgcacg cctgctcgaa 120
gggcagcagg ccgtgggccg ggccggcgag cggccggcgc gcgaagccgc ccaggacgtc 180
gcgcggccct ggctggccgg gcgcgcccag ccgctggcac gcgaggtgct gctgccgccg 240
gcgctgcgcg ccgatgtcga tacgaccctg ctgttcgcgg gcaaggccac gctgcccgtg 300
ctggccgagc gcctgcatcg cgccaccggc atcgccgtgc gcgtgcatcc cgacgcgctg 360
ctgccgcgcg ccgccttcct gccgcgcctg gcggggcagg ccgagctggc ggccgagcct 420
cccgcccagg ccgaactgcg ggccgggccg cgtccgctgg ccgacacgct cgacgcgctg 480
gccgcgcagc tgtacgtgca ctggcgctac catcgcggcg ccatcgagtt ctaccgcacc 540
gaaacgcggg tcttcgatgt gcgcacgctg gcgctggccg ccagcgcgca ggctcggctg 600
ggccgcgccg gcagcggcga gacgggcagt ttcgaccatg cctcgagcac ggtgctcagc 660
gccgacgccg gcaaggcgct gcaggccgtg cgggaccgcg tcgccgcttt cctgacgcgc 720
gccggcgtca tcgccgagat cgaggcgggc ggaagcacgc tcgcggtcac ggatacgccg 780
gaggcgctcg cgcgcatcga aaaatacctg caaggcgaga accgcgccct gacgcgccgg 840
gtacgcctgg tgttcgaaga gctcacggtg cgcaccacgg ccgccgccga aggcggcatc 900
gattggcagg cggtctacgc cagcgcgcgc gccgcggcgt cgtacgccat gcccggcggg 960
gccggcgcgg caggcgcgct cggggcccgc gtgctggccg ggccctggcg cgacgcgcgc 1020
gccctgatcg ccgcgctgag caccatggga gcggtactgc gccatcgcag catacccatg 1080
ctgacgctga accggcgcgc cgtcacccac gccgtgcgca ccacgttttc ctacgtggac 1140
caggtgcagc gcctgagccc gaccgcggcg gcgcccggtg ggcgcgatgc cgtgcccggg 1200
ctggcggtgc agcagaagcg cgagacggtg ggcacgttcc tcacgctgtt gcccgaggcg 1260
cgcgatgacg gccgcatcct gctctccatt tcctatgaca acaccattgc ccagccgctg 1320
cgcaccctga ccttcggcga gggcggccag caagtgtcgc tgcagcagat cgccatcgac 1380
ggcagcggca tcgtgcagca ggtcgagctg ctgcccggcc agcccgtcat cctgtcgggc 1440
ttcgaccaca gcgaagacca atacgaacgc caccgcctgt ttcccgatgc gccgctcgcg 1500
gccggcgggc acgaccgcac ggcgcgcgag cgggtcacga ccgtggtcat ggtcaccgcg 1560
cagatcgacg agggttga                                                1578
```

<210> 58
<211> 525
<212> PRT
<213> Bordetella pertussis

<400> 58
Met Lys Ala Arg Arg Leu Ala Met Ala Gly Leu Ser Leu Ala Leu Gly
 1   5   10   15
Gly Cys Ser Leu Ser Gln Gln Met Gln Ala Met Arg Asp Ala Ala Thr
            20   25   30
Ser Leu Arg Ala Arg Leu Leu Glu Gly Gln Gln Ala Val Gly Arg Ala
        35   40   45
Gly Glu Arg Pro Ala Arg Glu Ala Ala Gln Asp Val Ala Arg Pro Trp
    50   55   60
Leu Ala Gly Arg Ala Gln Pro Leu Ala Arg Glu Val Leu Leu Pro Pro
65   70   75   80
Ala Leu Arg Ala Asp Val Asp Thr Thr Leu Leu Phe Ala Gly Lys Ala
                85   90   95
Thr Leu Pro Val Leu Ala Glu Arg Leu His Arg Ala Thr Gly Ile Ala
            100   105   110
Val Arg Val His Pro Asp Ala Leu Leu Pro Arg Ala Ala Phe Leu Pro
        115   120   125
Arg Leu Ala Gly Gln Ala Glu Leu Ala Ala Glu Pro Pro Ala Gln Ala
    130   135   140
Glu Leu Arg Ala Gly Pro Arg Pro Leu Ala Asp Thr Leu Asp Ala Leu
145   150   155   160
Ala Ala Gln Leu Tyr Val His Trp Arg Tyr His Arg Gly Ala Ile Glu
                165   170   175
Phe Tyr Arg Thr Glu Thr Arg Val Phe Asp Val Arg Thr Leu Ala Leu
            180   185   190
Ala Ala Ser Ala Gln Ala Arg Leu Gly Arg Ala Gly Ser Gly Glu Thr
        195   200   205
Gly Ser Phe Asp His Ala Ser Ser Thr Val Leu Ser Ala Asp Ala Gly
    210   215   220
Lys Ala Leu Gln Ala Val Arg Asp Arg Val Ala Ala Phe Leu Thr Arg
225   230   235   240
Ala Gly Val Ile Ala Glu Ile Glu Ala Gly Gly Ser Thr Leu Ala Val
                245   250   255
Thr Asp Thr Pro Glu Ala Leu Ala Arg Ile Glu Lys Tyr Leu Gln Gly
            260   265   270
Glu Asn Arg Ala Leu Thr Arg Arg Val Arg Leu Val Phe Glu Glu Leu
        275   280   285
Thr Val Arg Thr Thr Ala Ala Ala Glu Gly Gly Ile Asp Trp Gln Ala
    290   295   300
Val Tyr Ala Ser Ala Arg Ala Ala Ala Ser Tyr Ala Met Pro Gly Gly
305   310   315   320
Ala Gly Ala Ala Gly Ala Leu Gly Ala Arg Val Leu Ala Gly Pro Trp
                325   330   335
Arg Asp Ala Arg Ala Leu Ile Ala Ala Leu Ser Thr Met Gly Ala Val
            340   345   350
Leu Arg His Arg Ser Ile Pro Met Leu Thr Leu Asn Arg Arg Ala Val
        355   360   365
Thr His Ala Val Arg Thr Thr Phe Ser Tyr Val Asp Gln Val Gln Arg
    370   375   380
Leu Ser Pro Thr Ala Ala Ala Pro Gly Gly Arg Asp Ala Val Pro Gly
385   390   395   400
Leu Ala Val Gln Gln Lys Arg Glu Thr Val Gly Thr Phe Leu Thr Leu
                405   410   415
Leu Pro Glu Ala Arg Asp Asp Gly Arg Ile Leu Leu Ser Ile Ser Tyr
            420   425   430

```
Asp Asn Thr Ile Ala Gln Pro Leu Arg Thr Leu Thr Phe Gly Glu Gly
        435                 440                 445
Gly Gln Gln Val Ser Leu Gln Gln Ile Ala Ile Asp Gly Ser Gly Ile
    450                 455                 460
Val Gln Gln Val Glu Leu Leu Pro Gly Gln Pro Val Ile Leu Ser Gly
465                 470                 475                 480
Phe Asp His Ser Glu Asp Gln Tyr Glu Arg His Arg Leu Phe Pro Asp
                485                 490                 495
Ala Pro Leu Ala Ala Gly Gly His Asp Arg Thr Ala Arg Glu Arg Val
            500                 505                 510
Thr Thr Val Val Met Val Thr Ala Gln Ile Asp Glu Gly
        515                 520                 525
```

<210> 59
<211> 1512
<212> DNA
<213> Bordetella pertussis

<400> 59

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gtgaccatgt tcatccgctg gctcattctc tccgcctgcc tgctgctggc cgcctgcagc 60
cgcgctcccg ataccgagat cctgcagcgc gatgtcggcc agaccctggc cgccacgtac 120
ggcccggacc tgttcgacat cgtcgcgctg cgccgcatgg gctcggccac cgacagcacg 180
gccccgccgg gccagacgcg ccgggtggtc tattacgatg tggtgctggg cctgaagaag 240
gacctcaccc tgggcgcctg ggaccagccc ggcgccgccg cgctggtcag cctgctgggc 300
gccgggccgc gcagcatctc gggggtgaaa tccagcggca atgccgccgg cgaccagatc 360
gtcgcccacg ccagcgccat ctaccagcgc gacgcagagc aatgggtgca cgtcgccccg 420
gccagcttca cggccaccga agcgccctcg ctggacaccg gcgcgccgcc gccggtgacg 480
cgccagctgc tccagacgct ggagcagatc acgcgttccg tgccctacag cgcctccagc 540
accgcccagc acgtggtgca acaggagctg gagcgctcgg tggcgcgcat caatggccgg 600
cttgcccgcc tgcaaaaggg ctacccgctg gcgaccggcc ccgacaaggg cgagtacctg 660
gcgttcggcc aggcgctggc cgcgatcggg cgcaacgagc aggtgcgcgt cattcccctc 720
attaccggcg gcagcgcgga caacatggcc atgctgcgca gcggcgcggc ggtggccgcc 780
ctgtcgcagg ccgacatcgc gcaactggcc tacgagggca aggggccgtt cgaaagccag 840
ggaccgttct ccgggttgcg cgcgctgggc agcctgtatc cggagctggt gcacatcgtg 900
gtgcgccagg gcgatggcat cgccacggtg ggcgcgctgc gcggcaagaa gattgccctg 960
ggcccgtcgg gctcggcggt acgcaccacg ctggagaccg tgctggcagc ccatgggctg 1020
cagccggggc gcgactatgc agtcatcgac acgccggccg ccgcggccct gccgcagctg 1080
agcgaaggac gggtcgacgc ggtggcgcag gtcatcggta cgccggccgc gcccttgcgc 1140
gcggcgctga cccaggcgcg cctggcgctg ctgccgctgg accgggctgc gatcgacaag 1200
ctggtgcagg ccgatccgac cctgatggcg ctggacatcc cggccaacac ctaccccagc 1260
caggccgcgg ccatccccac ggtgggcatg gcggcgctgc tggtcaccac ggccgatctg 1320
acgcgcgacg aggccgcgca tatggtggac gtggtatacc gggccgggca ggacctgctg 1380
gccgccgggt ccgcgcaggg cgcgcaggta tccgcggcca acgccgggcg cggattgagc 1440
attcccctgc acgacggcgc cgtggaagcc ttcgagaaac tgggcgcgcc gcccctgccc 1500
gagggcaggt ag                                                    1512
```

<210> 60
<211> 503
<212> PRT
<213> Bordetella pertussis

<400> 60

```
Val Thr Met Phe Ile Arg Trp Leu Ile Leu Ser Ala Cys Leu Leu Leu
 1               5                  10                  15
Ala Ala Cys Ser Arg Ala Pro Asp Thr Glu Ile Leu Gln Arg Asp Val
            20                  25                  30
Gly Gln Thr Leu Ala Ala Thr Tyr Gly Pro Asp Leu Phe Asp Ile Val
        35                  40                  45
Ala Leu Arg Arg Met Gly Ser Ala Thr Asp Ser Thr Ala Pro Pro Gly
    50                  55                  60
```

```
Gln Thr Arg Arg Val Val Tyr Tyr Asp Val Val Leu Gly Leu Lys Lys
65                  70                  75                  80
Asp Leu Thr Leu Gly Ala Trp Asp Gln Pro Gly Ala Ala Ala Leu Val
                85                  90                  95
Ser Leu Leu Gly Ala Gly Pro Arg Ser Ile Ser Gly Val Lys Ser Ser
            100                 105                 110
Gly Asn Ala Ala Gly Asp Gln Ile Val Ala His Ala Ser Ala Ile Tyr
        115                 120                 125
Gln Arg Asp Ala Glu Gln Trp Val His Val Ala Pro Ala Ser Phe Thr
    130                 135                 140
Ala Thr Glu Ala Pro Ser Leu Asp Thr Gly Ala Pro Pro Pro Val Thr
145                 150                 155                 160
Arg Gln Leu Leu Gln Thr Leu Glu Gln Ile Thr Arg Ser Val Pro Tyr
                165                 170                 175
Ser Ala Ser Ser Thr Ala Gln His Val Val Gln Gln Glu Leu Glu Arg
            180                 185                 190
Ser Val Ala Arg Ile Asn Gly Arg Leu Ala Arg Leu Gln Lys Gly Tyr
        195                 200                 205
Pro Leu Ala Thr Gly Pro Asp Lys Gly Glu Tyr Leu Ala Phe Gly Gln
    210                 215                 220
Ala Leu Ala Ala Ile Gly Arg Asn Glu Gln Val Arg Val Ile Pro Leu
225                 230                 235                 240
Ile Thr Gly Gly Ser Ala Asp Asn Met Ala Met Leu Arg Ser Gly Ala
                245                 250                 255
Ala Val Ala Ala Leu Ser Gln Ala Asp Ile Ala Gln Leu Ala Tyr Glu
            260                 265                 270
Gly Lys Gly Pro Phe Glu Ser Gln Gly Pro Phe Ser Gly Leu Arg Ala
        275                 280                 285
Leu Gly Ser Leu Tyr Pro Glu Leu Val His Ile Val Val Arg Gln Gly
    290                 295                 300
Asp Gly Ile Ala Thr Val Gly Ala Leu Arg Gly Lys Lys Ile Ala Leu
305                 310                 315                 320
Gly Pro Ser Gly Ser Ala Val Arg Thr Thr Leu Glu Thr Val Leu Ala
                325                 330                 335
Ala His Gly Leu Gln Pro Gly Arg Asp Tyr Ala Val Ile Asp Thr Pro
            340                 345                 350
Ala Ala Ala Ala Leu Pro Gln Leu Ser Glu Gly Arg Val Asp Ala Val
        355                 360                 365
Ala Gln Val Ile Gly Thr Pro Ala Ala Pro Leu Arg Ala Ala Leu Thr
    370                 375                 380
Gln Ala Arg Leu Ala Leu Leu Pro Leu Asp Arg Ala Ala Ile Asp Lys
385                 390                 395                 400
Leu Val Gln Ala Asp Pro Thr Leu Met Ala Leu Asp Ile Pro Ala Asn
                405                 410                 415
Thr Tyr Pro Ser Gln Ala Ala Ala Ile Pro Thr Val Gly Met Ala Ala
            420                 425                 430
Leu Leu Val Thr Thr Ala Asp Leu Thr Arg Asp Glu Ala Ala His Met
        435                 440                 445
Val Asp Val Val Tyr Arg Ala Gly Gln Asp Leu Leu Ala Ala Gly Ser
    450                 455                 460
Ala Gln Gly Ala Gln Val Ser Ala Ala Asn Ala Gly Arg Gly Leu Ser
465                 470                 475                 480
Ile Pro Leu His Asp Gly Ala Val Glu Ala Phe Glu Lys Leu Gly Ala
                485                 490                 495
Pro Pro Leu Pro Glu Gly Arg
            500
```

<210> 61
<211> 1494
<212> DNA

<213> Bordetella pertussis

<400> 61
atgatccgta tgcctggttt ccgattctcc gttccgccgc gccgccggct ggccgtcgcg 60

gcgctgtgcg cggcgctggg cggctgtgcg gtcgggcccg actaccagcg acccgccatc 120
gacgtggggg ccgcctacaa ggaggccgcc gcgccgcagc ccggctggac gcccgcgcag 180
cccagcgacg agagcgcgcg cgggcaatgg tggcaggtgt atggcgaccc ggtgctcgac 240
ggcctggtgc agcaattgaa ccagggcaac tactccgtgg cgcaggccga ggccaattat 300
cgccaggccc aggcgctggt gcgcaatgcg cgcgccggct tcttccccac cataggcgcg 360
ggcgccgacg tgacgcggtc cggctcgggc ggcggcagcg gcgccggctc gaacggcagc 420
tcggtcggca accagtactc gctcagtggg tcggtcagct gggaagtcga tgtgtggggc 480
cgggtgcgcc gcgaagtcga gtccagccgc gccgaggcgc aggccagcgc ggcggacctg 540
gccgtcaccc gcctgagcgc gcaggccgcc ctggtgcaga actacctgca attgcgcgtg 600
ctcgacgagc agaaacgcct gctcgacgcc acggtgctgg cctacgagcg ctcgctgcgc 660
ctgacgcaga accgctacga agccggcgtg gtgggcaagt ccgacgtggc ggtggcgcgc 720
acccagctgg agaacacgcg ggcccagtcc atcgacctgg actggcagcg cggccagttc 780
gagcacgcca tcgcggtgct gatggggcag gcgccttcgc gcttcgccct gccggcgcag 840
ccgttcgcgc agcaactgcc ggacatcccg gcgggcctgc cctcgcaact gctggagcgc 900
cggcccgacg tggcggccgc cgagcggcgc gcggccgccg ccaatgcgca gatcggcgtg 960
gcgcaggcgg cctggttccc ggacctgacc ttgtcggcca gcggcggttt tcgcagcggc 1020
cagttcgccg agtggctgac cgcgccggcg cgcttctgga ccctcggccc ggcgctggcc 1080
atgacgctgt tcgacggcgg cgcgcgttcg gcgcgcgtcg agcaggcccg cgccgcctat 1140
gacgcgcagg cggccgccta ccgccagagc gtgctgacgg cgctgcgcga ggtggaggat 1200
tacctggtgc agctgcgcgt gatggagcac gagcagcagg tgcagcgcaa tgcgctcgag 1260
tccgcgcgcg aatcgctgcg cctggcgcgc aaccagtacg agcaggggct gatcgactac 1320
ctgagcgtgg cggtgctgga aaccaccgcg ctgaacaccg agcgcaacgc catcagcctg 1380
ctgggcagcc ggctcaacgc cagcgtgcag ctgatcgcgg cgctgggcgg cgggtggcag 1440
ggcttgccgg ccgaggcggc ggccagcgcg gcggccgagc cgtccgcgcc ctag 1494

<210> 62
<211> 497
<212> PRT
<213> Bordetella pertussis

<400> 62
Met Ile Arg Met Pro Gly Phe Arg Phe Ser Val Pro Pro Arg Arg Arg
 1   5   10   15
Leu Ala Val Ala Ala Leu Cys Ala Ala Leu Gly Gly Cys Ala Val Gly
            20   25   30
Pro Asp Tyr Gln Arg Pro Ala Ile Asp Val Gly Ala Ala Tyr Lys Glu
        35   40   45
Ala Ala Ala Pro Gln Pro Gly Trp Thr Pro Ala Gln Pro Ser Asp Glu
    50   55   60
Ser Ala Arg Gly Gln Trp Trp Gln Val Tyr Gly Asp Pro Val Leu Asp
65   70   75   80
Gly Leu Val Gln Gln Leu Asn Gln Gly Asn Tyr Ser Val Ala Gln Ala
                85   90   95
Glu Ala Asn Tyr Arg Gln Ala Gln Ala Leu Val Arg Asn Ala Arg Ala
            100   105   110
Gly Phe Phe Pro Thr Ile Gly Ala Gly Ala Asp Val Thr Arg Ser Gly
        115   120   125
Ser Gly Gly Gly Ser Gly Ala Gly Ser Asn Gly Ser Ser Val Gly Asn
    130   135   140
Gln Tyr Ser Leu Ser Gly Ser Val Ser Trp Glu Val Asp Val Trp Gly
145   150   155   160
Arg Val Arg Arg Glu Val Glu Ser Ser Arg Ala Glu Ala Gln Ala Ser
                165   170   175
Ala Ala Asp Leu Ala Val Thr Arg Leu Ser Ala Gln Ala Ala Leu Val
            180   185   190
Gln Asn Tyr Leu Gln Leu Arg Val Leu Asp Glu Gln Lys Arg Leu Leu

```
        195                 200                 205
Asp Ala Thr Val Leu Ala Tyr Glu Arg Ser Leu Arg Leu Thr Gln Asn
    210                 215                 220
Arg Tyr Glu Ala Gly Val Val Gly Lys Ser Asp Val Ala Val Ala Arg
225                 230                 235                 240
Thr Gln Leu Glu Asn Thr Arg Ala Gln Ser Ile Asp Leu Asp Trp Gln
                245                 250                 255
Arg Gly Gln Phe Glu His Ala Ile Ala Val Leu Met Gly Gln Ala Pro
            260                 265                 270
Ser Arg Phe Ala Leu Pro Ala Gln Pro Phe Ala Gln Gln Leu Pro Asp
        275                 280                 285
Ile Pro Ala Gly Leu Pro Ser Gln Leu Leu Glu Arg Arg Pro Asp Val
    290                 295                 300
Ala Ala Ala Glu Arg Arg Ala Ala Ala Ala Asn Ala Gln Ile Gly Val
305                 310                 315                 320
Ala Gln Ala Ala Trp Phe Pro Asp Leu Thr Leu Ser Ala Ser Gly Gly
                325                 330                 335
Phe Arg Ser Gly Gln Phe Ala Glu Trp Leu Thr Ala Pro Ala Arg Phe
            340                 345                 350
Trp Thr Leu Gly Pro Ala Leu Ala Met Thr Leu Phe Asp Gly Gly Ala
        355                 360                 365
Arg Ser Ala Arg Val Glu Gln Ala Arg Ala Ala Tyr Asp Ala Gln Ala
    370                 375                 380
Ala Ala Tyr Arg Gln Ser Val Leu Thr Ala Leu Arg Glu Val Glu Asp
385                 390                 395                 400
Tyr Leu Val Gln Leu Arg Val Met Glu His Glu Gln Gln Val Gln Arg
                405                 410                 415
Asn Ala Leu Glu Ser Ala Arg Glu Ser Leu Arg Leu Ala Arg Asn Gln
            420                 425                 430
Tyr Glu Gln Gly Leu Ile Asp Tyr Leu Ser Val Ala Val Leu Glu Thr
        435                 440                 445
Thr Ala Leu Asn Thr Glu Arg Asn Ala Ile Ser Leu Leu Gly Ser Arg
    450                 455                 460
Leu Asn Ala Ser Val Gln Leu Ile Ala Ala Leu Gly Gly Gly Trp Gln
465                 470                 475                 480
Gly Leu Pro Ala Glu Ala Ala Ala Ser Ala Ala Ala Glu Pro Ser Ala
                485                 490                 495
Pro
```

<210> 63
<211> 1494
<212> DNA
<213> Bordetella pertussis

<400> 63
atgacgcatc ccgtcccgac gacctttgca cgtaccgccg gcgcgctgct tgccgcgctg 60
gcgctggccg gctgcgccgt ggggccgcag taccaggcgc ccacgcccgc gccggtgaag 120
ctggccagcc ccgaacaggc gctgttctcg gccgaccggt tgcaacgcga atggtggcgc 180
cagttgcagg atgcccggct ggacgcgttg atcggcctgg cgctggcgcg caacctcgat 240
atcggcctgg cgctggcgcg caacctcgat atccgccagg cgcaggcgcg cctgcgcgaa 300
gcgcgcgccg cgctcgacga aaaggaactg gaccgctggc cgaccgtgac cgcggccggc 360
ggctacacgc gcagcctgtc gcagatcaac cccggccccg accagcgcaa cctcgcgcaa 420
agctaccgcg cgggcttcga cgcgacctgg gaaatcgatt tgttcggccg cctgcagcga 480
cgggccgagg ccgcggccgc gcgcgaccag gccgccgccg ccgacctggc ccagacgcgc 540
ctggtggtgg tggccgagct ggcacgcaac tatttcgaga tgcgcggcgc cgagcaacgg 600
ctggccgtgg cgcgcgccaa cctcgccacc cagcaggaga cgctgcgcgt caccgcggcg 660
ctggtggaaa ccggccgcgg ctatgccggc gacctggcca gcgcacgggc cgagctggcc 720
ggcacgcggg cgctgctcgc gccgctggag acgcaacggc gcctggccca gtaccacatc 780
gccgtcctgg cggccatgcg gccggccgag ctgggcgagc tgcggcagga gcagccgctg 840

```
gcgccgctgg ccgcgcaatt gcccatcggc gacgtggcca tgctgctgca acgccgcccc 900
gacgtgcgcg ccgccgagcg cctgctggcc gccaccaacg ccgacgtcgg cgccatcacc 960
gccgaactgt atccgcgcat cgacctgggc gggttcctcg gtttcattgc cttgcgcggc 1020
ggcgacctgg gccaggccag cagcaaggcc ttcgcgctgg cgccgacgat cagctggccg 1080
gcgttgcacc tgggcagcgt ccaggcgcag ctgcgcgcgg gccaggcccg gcacgacgcg 1140
gcgcgggcgc gctacgaaca ggtggcgctg caggccatcg aggaagtgga aggcgcgttg 1200
acgcgctatg gacagaacca gcagcggctg cgcgacctgc ttgacagcgc cacgcagagc 1260
cagcgcgccg ccgacctggc gcaaacgcgc tatcgtgaag gggccgcgcc gtatttgacg 1320
gtgctggacg cgcagcgtac tcttttgcgc gcacaggatg ccgtggcgca atccgagtcg 1380
gagtcctata ccagcctggt cgcgctctac aaggccctgg gcggaggctg gaataccgac 1440
gccgccgcgc ccgcccgttc cgcccgcacc gccgccctgc cggccagccc ctga       1494
```

<210> 64
<211> 497
<212> PRT
<213> Bordetella pertussis

<400> 64

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Met Thr His Pro Val Pro Thr Thr Phe Ala Arg Thr Ala Gly Ala Leu
 1               5                  10                  15
Leu Ala Ala Leu Ala Leu Ala Gly Cys Ala Val Gly Pro Gln Tyr Gln
            20                  25                  30
Ala Pro Thr Pro Ala Pro Val Lys Leu Ala Ser Pro Glu Gln Ala Leu
        35                  40                  45
Phe Ser Ala Asp Arg Leu Gln Arg Glu Trp Trp Arg Gln Leu Gln Asp
    50                  55                  60
Ala Arg Leu Asp Ala Leu Ile Gly Leu Ala Leu Ala Arg Asn Leu Asp
65                  70                  75                  80

Ile Gly Leu Ala Leu Ala Arg Asn Leu Asp Ile Arg Gln Ala Gln Ala
                85                  90                  95
Arg Leu Arg Glu Ala Arg Ala Ala Leu Asp Glu Lys Glu Leu Asp Arg
            100                 105                 110
Trp Pro Thr Val Thr Ala Ala Gly Gly Tyr Thr Arg Ser Leu Ser Gln
        115                 120                 125
Ile Asn Pro Gly Pro Asp Gln Arg Asn Leu Ala Gln Ser Tyr Arg Ala
    130                 135                 140
Gly Phe Asp Ala Thr Trp Glu Ile Asp Leu Phe Gly Arg Leu Gln Arg
145                 150                 155                 160
Arg Ala Glu Ala Ala Ala Ala Arg Asp Gln Ala Ala Ala Ala Asp Leu
                165                 170                 175
Ala Gln Thr Arg Leu Val Val Val Ala Glu Leu Ala Arg Asn Tyr Phe
            180                 185                 190
Glu Met Arg Gly Ala Glu Gln Arg Leu Ala Val Ala Arg Ala Asn Leu
        195                 200                 205
Ala Thr Gln Gln Glu Thr Leu Arg Val Thr Ala Ala Leu Val Glu Thr
    210                 215                 220
Gly Arg Gly Tyr Ala Gly Asp Leu Ala Ser Ala Arg Ala Glu Leu Ala
225                 230                 235                 240
Gly Thr Arg Ala Leu Leu Ala Pro Leu Glu Thr Gln Arg Arg Leu Ala
                245                 250                 255
Gln Tyr His Ile Ala Val Leu Ala Ala Met Arg Pro Ala Glu Leu Gly
            260                 265                 270
Glu Leu Arg Gln Glu Gln Pro Leu Ala Pro Leu Ala Ala Gln Leu Pro
        275                 280                 285
Ile Gly Asp Val Ala Met Leu Leu Gln Arg Arg Pro Asp Val Arg Ala
    290                 295                 300
Ala Glu Arg Leu Leu Ala Ala Thr Asn Ala Asp Val Gly Ala Ile Thr
305                 310                 315                 320
Ala Glu Leu Tyr Pro Arg Ile Asp Leu Gly Gly Phe Leu Gly Phe Ile
                325                 330                 335
```

```
Ala Leu Arg Gly Gly Asp Leu Gly Gln Ala Ser Ser Lys Ala Phe Ala
            340                 345                 350
Leu Ala Pro Thr Ile Ser Trp Pro Ala Leu His Leu Gly Ser Val Gln
        355                 360                 365
Ala Gln Leu Arg Ala Gly Gln Ala Arg His Asp Ala Ala Arg Ala Arg
    370                 375                 380
Tyr Glu Gln Val Ala Leu Gln Ala Ile Glu Glu Val Glu Gly Ala Leu
385                 390                 395                 400
Thr Arg Tyr Gly Gln Asn Gln Gln Arg Leu Arg Asp Leu Leu Asp Ser
                405                 410                 415
Ala Thr Gln Ser Gln Arg Ala Ala Asp Leu Ala Gln Thr Arg Tyr Arg

            420                 425                 430
Glu Gly Ala Ala Pro Tyr Leu Thr Val Leu Asp Ala Gln Arg Thr Leu
        435                 440                 445
Leu Arg Ala Gln Asp Ala Val Ala Gln Ser Glu Ser Glu Ser Tyr Thr
    450                 455                 460
Ser Leu Val Ala Leu Tyr Lys Ala Leu Gly Gly Gly Trp Asn Thr Asp
465                 470                 475                 480
Ala Ala Ala Pro Ala Arg Ser Ala Arg Thr Ala Ala Leu Pro Ala Ser
                485                 490                 495
Pro
```

<210> 65
<211> 1383
<212> DNA
<213> Bordetella pertussis

<400> 65
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atgaaacctg tcgtcatgag aaccttgttg tcccttgccg tggccacggc cctggccggc 60
tgctcgctgg cgcccaccta cgagcgcccg caggcgccgg tcgacgcggc ctatccgtcc 120
ggcccggcct acggcgcgcc gggccaggcc gccgcgggcg cgccggccgc cgccgacgtg 180
ggctggcgcg acttcttcgg cgacccgctg ctgcaggagc tgctggcgct gtcgctggcc 240
aacaaccgcg acctgcgggt cgccgcgctc aacgtggagg cggcgcgcct caacccgagc 300
ggacaggccg gcatcagccg cagctaccag gtcggtgcca gcctgtcgac ctgggagctg 360
gacctgttcg ggcgcatccg cagcctcagc gaacaggcgc tgcagctcta tctggcccag 420
gacgaaacgc gcctggccac ccagctgacg ctggtggccg agaccgccaa cgcctacccg 480
accctgcgcg ccgaccagga actgctggcg ctgacgcgcc agacgctggc ggcccagcag 540
gagtcgtaca agctgacccg ccagagctac gacctgggcg tggcgaccga gctggacctg 600
agccaggccg agatttcgct gcgcaccgcc gagcgcaatc tgtcgcagta cacgcgcatg 660
gcggcgcagg accgcaacgc gctggtgctg ctggtgggcc agccgctgcc ggccggcatc 720
ggcgcgcagc tggaccaggc cgtggcgctg cccgacggcg tggtcctggc cgacctgccg 780
gcgggcctgc cgtcggatct gctcgcgcgc cggccggata tccgcgcggc ggagcaccag 840
ctgcaagccg ccaacgccag catcggcgcg gcgcgcgcgg cgttcttccc gcgcatcagc 900
ctgaccggct cggccggcac ggccagcgcc agcctgggcg gcctgttcga tgccgggtcg 960
ggggcctgga gtttcgcgcc gcagatcagc gtgccgatct tcgcgggcgg ggcgctgcgc 1020
gccagcctgg acctggccaa gatccagaag gacatcggca tcgcgcgcta cgagcaggcc 1080
atccagagcg ggttccgcga ggtctccgac gcgctggccg gccgcggcac attgcaggag 1140
cagatccggt cgcaggaact gctggtgcag gccaaccagc gcgcctacga cctgtcgcag 1200
cagcgttacc agcagggcat cgacaactat ctcagcgtgc tggattcgca gcgttcgctg 1260
tatacggcgc agcagacgct ggtcgagacg cggctggcgc gcctgtccaa cctgatccag 1320
ctctacaagg cgctgggcgg cggctggtcc gagcgcacgg tggcggcggc gcaggccggc 1380
tga                                                                 1383
```

<210> 66
<211> 460
<212> PRT
<213> Bordetella pertussis

<400> 66
Met Lys Pro Val Val Met Arg Thr Leu Leu Ser Leu Ala Val Ala Thr
 1   5   10   15
Ala Leu Ala Gly Cys Ser Leu Ala Pro Thr Tyr Glu Arg Pro Gln Ala
            20   25   30
Pro Val Asp Ala Ala Tyr Pro Ser Gly Pro Ala Tyr Gly Ala Pro Gly
        35   40   45
Gln Ala Ala Ala Gly Ala Pro Ala Ala Ala Asp Val Gly Trp Arg Asp
    50   55   60
Phe Phe Gly Asp Pro Leu Leu Gln Glu Leu Leu Ala Leu Ser Leu Ala
65   70   75   80
Asn Asn Arg Asp Leu Arg Val Ala Ala Leu Asn Val Glu Ala Ala Arg
                85   90   95
Leu Asn Pro Ser Gly Gln Ala Gly Ile Ser Arg Ser Tyr Gln Val Gly
            100   105   110
Ala Ser Leu Ser Thr Trp Glu Leu Asp Leu Phe Gly Arg Ile Arg Ser
        115   120   125
Leu Ser Glu Gln Ala Leu Gln Leu Tyr Leu Ala Gln Asp Glu Thr Arg
    130   135   140
Leu Ala Thr Gln Leu Thr Leu Val Ala Glu Thr Ala Asn Ala Tyr Pro
145   150   155   160
Thr Leu Arg Ala Asp Gln Glu Leu Leu Ala Leu Thr Arg Gln Thr Leu
                165   170   175
Ala Ala Gln Gln Glu Ser Tyr Lys Leu Thr Arg Gln Ser Tyr Asp Leu
            180   185   190
Gly Val Ala Thr Glu Leu Asp Leu Ser Gln Ala Glu Ile Ser Leu Arg
        195   200   205
Thr Ala Glu Arg Asn Leu Ser Gln Tyr Thr Arg Met Ala Ala Gln Asp
    210   215   220
Arg Asn Ala Leu Val Leu Leu Val Gly Gln Pro Leu Pro Ala Gly Ile
225   230   235   240
Gly Ala Gln Leu Asp Gln Ala Val Ala Leu Pro Asp Gly Val Val Leu
                245   250   255
Ala Asp Leu Pro Ala Gly Leu Pro Ser Asp Leu Leu Ala Arg Arg Pro
            260   265   270
Asp Ile Arg Ala Ala Glu His Gln Leu Gln Ala Ala Asn Ala Ser Ile
        275   280   285
Gly Ala Ala Arg Ala Ala Phe Phe Pro Arg Ile Ser Leu Thr Gly Ser
    290   295   300
Ala Gly Thr Ala Ser Ala Ser Leu Gly Gly Leu Phe Asp Ala Gly Ser
305   310   315   320
Gly Ala Trp Ser Phe Ala Pro Gln Ile Ser Val Pro Ile Phe Ala Gly
                325   330   335
Gly Ala Leu Arg Ala Ser Leu Asp Leu Ala Lys Ile Gln Lys Asp Ile
            340   345   350
Gly Ile Ala Arg Tyr Glu Gln Ala Ile Gln Ser Gly Phe Arg Glu Val
        355   360   365
Ser Asp Ala Leu Ala Gly Arg Gly Thr Leu Gln Glu Gln Ile Arg Ser
    370   375   380
Gln Glu Leu Leu Val Gln Ala Asn Gln Arg Ala Tyr Asp Leu Ser Gln
385   390   395   400
Gln Arg Tyr Gln Gln Gly Ile Asp Asn Tyr Leu Ser Val Leu Asp Ser
                405   410   415
Gln Arg Ser Leu Tyr Thr Ala Gln Gln Thr Leu Val Glu Thr Arg Leu
            420   425   430
Ala Arg Leu Ser Asn Leu Ile Gln Leu Tyr Lys Ala Leu Gly Gly Gly
        435   440   445
Trp Ser Glu Arg Thr Val Ala Ala Ala Gln Ala Gly
    450   455   460

<210> 67
<211> 1350
<212> DNA
<213> Bordetella pertussis

<400> 67
atgaaacagc ataaggtcgg caggcactgg gcaggatggg cgatggcgct ggcgtgcctg 60
ggcgcggccg cgccgctggc ggcgcagccg gcggcaccag ctggggccgc gcaggcgcgc 120
gaactgctgc tggaggtcaa gggccagcag ccgttgcgcc tggacgccgc gccatcgcgc 180
gtggcgatcg ccgatccgca ggtcgccgac gtcaaggtgc tggcgcccgg cgtgggccgc 240
ccgggcgagg tgctgctgat cggccggcag gccggcacca ccgagctgcg ggtctggagc 300
cgcggctcgc gcgacccgca ggtctggacc gtgcgcgtgc tgccgcaagt gcaggccgcg 360
ctggcgcggc gcggcgtcgg cggcggcgcg caggtcgaca tggctggcga cagcggcgtg 420
gtcaccggca tggcgccctc ggccgaggcg catcgcggcg cggccgaggc tgccgcggcc 480
gccgcgggcg gcaacgacaa ggtggtcgac atgtcgcaga tcaacaccag cggcgtggtg 540
caggtggaag tgaaagtggt cgagctggcg cgctcggtca tgaaggatgt cgggatcaat 600
ttcagggccg acagcggccc gtggtcgggc ggcgtgtcgc tgctgccgga cctggccagc 660
ggcggcatgt tcggcatgct gtcctatacc agccgcgatt tcagcgcgtc gctggcgctg 720
ctgcaaaaca acggcatggc gcgcgtcctg gccgagccga cgctgctggc catgtcgggc 780
cagagcgcca gcttcctggc cggcggcgag attccgattc cggtatcggc cggcctgggt 840
acgacctcgg tgcagttcaa gcccttcggc atcggcctga cggtcacgcc cacggtcatc 900
tcgcgcgagc gcatcgcgct gaaggtggcg cccgaagcca gcgagctgga ctacgccaac 960
ggcatttcca gcatcgacag caacaatcgc atcacggtga tcccggcgtt gcgaacccgc 1020
aaggccgaca ccatggtgga gctgggcgat ggcgagacat tcgtcatcag cggcctggtt 1080
tcgcgccaga ccaaggccag cgtcaacaag gtgccgctgt tgggcgacct gcccatcatc 1140
ggggcgttct tccgcaacgt gcagtattcc caggaggatc gcgaattggt gatcgtggtc 1200
acgccgcgcc tggttcgccc catcgcgcgc ggtgtcacgc tgcccttgcc gggcgcgcgc 1260
caggaggtca gcgacgctgg cttcaacgcc tggggctatt acctgctggg tccgatgagc 1320
ggccagcaga tgccgggctt ttcacagtga 1350

<210> 68
<211> 449
<212> PRT
<213> Bordetella pertussis

<400> 68
Met Lys Gln His Lys Val Gly Arg His Trp Ala Gly Trp Ala Met Ala
 1   5   10   15
Leu Ala Cys Leu Gly Ala Ala Ala Pro Leu Ala Ala Gln Pro Ala Ala
            20   25   30
Pro Ala Gly Ala Ala Gln Ala Arg Glu Leu Leu Leu Glu Val Lys Gly
        35   40   45
Gln Gln Pro Leu Arg Leu Asp Ala Ala Pro Ser Arg Val Ala Ile Ala
    50   55   60
Asp Pro Gln Val Ala Asp Val Lys Val Leu Ala Pro Gly Val Gly Arg
65   70   75   80
Pro Gly Glu Val Leu Leu Ile Gly Arg Gln Ala Gly Thr Thr Glu Leu
                85   90   95
Arg Val Trp Ser Arg Gly Ser Arg Asp Pro Gln Val Trp Thr Val Arg
            100   105   110
Val Leu Pro Gln Val Gln Ala Ala Leu Ala Arg Arg Gly Val Gly Gly
        115   120   125
Gly Ala Gln Val Asp Met Ala Gly Asp Ser Gly Val Val Thr Gly Met
    130   135   140
Ala Pro Ser Ala Glu Ala His Arg Gly Ala Ala Glu Ala Ala Ala Ala
145   150   155   160
Ala Ala Gly Gly Asn Asp Lys Val Val Asp Met Ser Gln Ile Asn Thr
                165   170   175
Ser Gly Val Val Gln Val Glu Val Lys Val Val Glu Leu Ala Arg Ser
            180   185   190
Val Met Lys Asp Val Gly Ile Asn Phe Arg Ala Asp Ser Gly Pro Trp

```
        195                 200                 205
Ser Gly Gly Val Ser Leu Leu Pro Asp Leu Ala Ser Gly Gly Met Phe
    210                 215                 220
Gly Met Leu Ser Tyr Thr Ser Arg Asp Phe Ser Ala Ser Leu Ala Leu
225                 230                 235                 240
Leu Gln Asn Asn Gly Met Ala Arg Val Leu Ala Glu Pro Thr Leu Leu
                245                 250                 255
Ala Met Ser Gly Gln Ser Ala Ser Phe Leu Ala Gly Gly Glu Ile Pro
            260                 265                 270
Ile Pro Val Ser Ala Gly Leu Gly Thr Thr Ser Val Gln Phe Lys Pro
        275                 280                 285
Phe Gly Ile Gly Leu Thr Val Thr Pro Thr Val Ile Ser Arg Glu Arg
    290                 295                 300
Ile Ala Leu Lys Val Ala Pro Glu Ala Ser Glu Leu Asp Tyr Ala Asn
305                 310                 315                 320
Gly Ile Ser Ser Ile Asp Ser Asn Asn Arg Ile Thr Val Ile Pro Ala
                325                 330                 335
Leu Arg Thr Arg Lys Ala Asp Thr Met Val Glu Leu Gly Asp Gly Glu
            340                 345                 350
Thr Phe Val Ile Ser Gly Leu Val Ser Arg Gln Thr Lys Ala Ser Val
        355                 360                 365
Asn Lys Val Pro Leu Leu Gly Asp Leu Pro Ile Ile Gly Ala Phe Phe
    370                 375                 380
Arg Asn Val Gln Tyr Ser Gln Glu Asp Arg Glu Leu Val Ile Val Val
385                 390                 395                 400
Thr Pro Arg Leu Val Arg Pro Ile Ala Arg Gly Val Thr Leu Pro Leu
                405                 410                 415
Pro Gly Ala Arg Gln Glu Val Ser Asp Ala Gly Phe Asn Ala Trp Gly
            420                 425                 430
Tyr Tyr Leu Leu Gly Pro Met Ser Gly Gln Gln Met Pro Gly Phe Ser
        435                 440                 445
Gln
```

<210> 69
<211> 1290
<212> DNA
<213> Bordetella pertussis

<400> 69

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atgaagcgac ttctctgtct gtccctgctg tccgtattgc tggcggcgtg cacgacccca 60
tcgcagattc cgcccgagac ggcgcccggc ggcgtgccgc cggcggccga aggtccgctg 120
gtcgtgccgc cgctgtcggc gctgtccgac accccgccgc gcgcgctggc cgggcgctac 180
cagcgcgttg cctggaccga gctgcccaac tgggagagcg acgacctgtc gcgctggtgg 240
ccgctgttcc tgcgcaattg caaaggcctg atgcggccga ccagcggtaa cctggcggcg 300
ccggcacgcg ccacgccgcg cgcctggcag cccgtgtgcg cggcggcggt cgacccgtcc 360
aaggcgccgg ccgccggcga cagcgcggcg gtgcggcgct tcctgcagac ctggctgcag 420
ccctggcgca tcgccggcgc cgacggccgt cccgccacca ataccgtcac cggctactac 480
gagccgctgg tgcgcggctc gcgccgccag ggcggccgct accagtggcc gctgtatgcc 540
gtgccggccg acctgctcgt cgtcgacctg ggctcggtct atcccgacct gaccggcaag 600
cgcgtgcgcg gccggctcga cggccgccgg gtcgtgccct acgacacgcg cgccgcgatc 660
gaggcgggcg accgcaagcc gccggccatc gtctgggtgg acgatccggt cgacaatttc 720
ttcctgcagg tccaggggtc gggccgggtg cagctgaccg atggccccga ccgcggcacc 780
acgatccgcg tcgcgtacgc cgaccataac ggccagccct atgcctccat cggccgctgg 840
ctcatcgaca agggcgagct gcgcgccgac caggcatcga tgcagaacat ccgtgcctgg 900
gcccaacgca atccctcgcg cgtgcaggaa atgctcaacg ccaacccggc ggtggtcttc 960
ttccgcgaag aggcggtggt cgatccggag caagggccca agggggccta tggcatcccg 1020
ttggcgccgc agcgctcgat cgcggtcgac gccggtttcg tgccgctggg cacgccggtc 1080
tacctgtcga ccacgctgcc ggcctccgac cggcccctgc agcgcaccgt gttcgcgcag 1140
```

gacaccggca cggccattcg cggcgcggcg cgcgccgact tctattgggg ctacggcgag 1200
gaagccggcc agcaggccgg gcgcatgaag cagcgcggcc agatgtggct gctgtggccc 1260
aagcaggccg gggagccgtc ggcgcgatga 1290

<210> 70
<211> 429
<212> PRT
<213> Bordetella pertussis

<400> 70
Met Lys Arg Leu Leu Cys Leu Ser Leu Leu Ser Val Leu Leu Ala Ala
1 5 10 15
Cys Thr Thr Pro Ser Gln Ile Pro Pro Glu Thr Ala Pro Gly Gly Val
20 25 30
Pro Pro Ala Ala Glu Gly Pro Leu Val Val Pro Pro Leu Ser Ala Leu
35 40 45
Ser Asp Thr Pro Pro Arg Ala Leu Ala Gly Arg Tyr Gln Arg Val Ala
50 55 60
Trp Thr Glu Leu Pro Asn Trp Glu Ser Asp Asp Leu Ser Arg Trp Trp
65 70 75 80
Pro Leu Phe Leu Arg Asn Cys Lys Gly Leu Met Arg Pro Thr Ser Gly
85 90 95
Asn Leu Ala Ala Pro Ala Arg Ala Thr Pro Arg Ala Trp Gln Pro Val
100 105 110
Cys Ala Ala Ala Val Asp Pro Ser Lys Ala Pro Ala Ala Gly Asp Ser
115 120 125
Ala Ala Val Arg Arg Phe Leu Gln Thr Trp Leu Gln Pro Trp Arg Ile
130 135 140
Ala Gly Ala Asp Gly Arg Pro Ala Thr Asn Thr Val Thr Gly Tyr Tyr
145 150 155 160
Glu Pro Leu Val Arg Gly Ser Arg Arg Gln Gly Gly Arg Tyr Gln Trp
165 170 175
Pro Leu Tyr Ala Val Pro Ala Asp Leu Leu Val Val Asp Leu Gly Ser
180 185 190
Val Tyr Pro Asp Leu Thr Gly Lys Arg Val Arg Gly Arg Leu Asp Gly
195 200 205
Arg Arg Val Val Pro Tyr Asp Thr Arg Ala Ala Ile Glu Ala Gly Asp
210 215 220
Arg Lys Pro Pro Ala Ile Val Trp Val Asp Asp Pro Val Asp Asn Phe
225 230 235 240
Phe Leu Gln Val Gln Gly Ser Gly Arg Val Gln Leu Thr Asp Gly Pro
245 250 255
Asp Arg Gly Thr Thr Ile Arg Val Ala Tyr Ala Asp His Asn Gly Gln
260 265 270
Pro Tyr Ala Ser Ile Gly Arg Trp Leu Ile Asp Lys Gly Glu Leu Arg
275 280 285
Ala Asp Gln Ala Ser Met Gln Asn Ile Arg Ala Trp Ala Gln Arg Asn
290 295 300
Pro Ser Arg Val Gln Glu Met Leu Asn Ala Asn Pro Ala Val Val Phe
305 310 315 320
Phe Arg Glu Glu Ala Val Val Asp Pro Glu Gln Gly Pro Lys Gly Ala
325 330 335
Tyr Gly Ile Pro Leu Ala Pro Gln Arg Ser Ile Ala Val Asp Ala Gly
340 345 350
Phe Val Pro Leu Gly Thr Pro Val Tyr Leu Ser Thr Thr Leu Pro Ala
355 360 365
Ser Asp Arg Pro Leu Gln Arg Thr Val Phe Ala Gln Asp Thr Gly Thr
370 375 380
Ala Ile Arg Gly Ala Ala Arg Ala Asp Phe Tyr Trp Gly Tyr Gly Glu
385 390 395 400
Glu Ala Gly Gln Gln Ala Gly Arg Met Lys Gln Arg Gly Gln Met Trp

```
                405                 410                 415
Leu Leu Trp Pro Lys Gln Ala Gly Glu Pro Ser Ala Arg
            420                 425
```

<210> 71
<211> 1146
<212> DNA
<213> Bordetella pertussis

<400> 71
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atgttcaact gtcggcgatt cctgcaaatc ggcacgctgt cggccctgct ggccggctgt 60
gccacctcca gccaaacacc ccaagcccag catcttcccg cgcaggccgc cacaggccag 120
gccgaccgcg tccgcatcgg cccggacaaa cccgtatcga gcgacgaagg ccccgccacg 180
ctgacgccga ccggcgaact gcggcccgac gtccgcgcct tcgccgaaca gctggcggcg 240
cagcgcgagc tgcccctgcc gcaagtgctg gccagcctgg aaagcacgcg ctacaacgcg 300
accgtcgccc gcctcatcgc cccgtccggc gcgtcgggca agaaaatctg gcgcagctgg 360
ctgacctatc gcgggcgttt cgtcgaaccc aagcgcatcg cctggggcgt ggaattctgg 420
aacgccaacc aggacctgct caaccgcgcc gcccagcgct acggcgtgcc ggcctcgatc 480
atcgcctcca tcatcggcgt ggaaaccctg tatggccgca acgtgggcaa cttccgcgtg 540
gtcgacgccc tggcgacgct ggcattcgac tacctcgatc ccgccaagcc cgagcgcgcc 600
gacatgttcc gcggccagct cggcgacttc atcaccctgg cgctgcagga caagctggac 660
cccgagacgc gcggctcgta cgccggcgcc atcggcatgc cgcaattcat gcccggcagc 720
atcatgcgct atgcggtcga tggcgatgac gacggccaca tcgacctgac caacagcgtc 780
gcggacgcgg tcatgtcggt gggcaacttc ctggtcgaac atggctggca gcgcggcctg 840
ccggtgttcg cgccggtcgc gctgccggcc gatccggcgc cgctggtggc cggcggcctt 900
acgccgacgc tggactggaa cggcctgcag gccgccggcg cgcgcccggc ggcgggcgcc 960
ggacgcggcg cctggcagga gcaccccatg ggcatcgtgg acctggtcga ggaagcgcgc 1020
ggcaccgtgc aataccgtac cgccacgccc aatttctttg ccctgacgca atacaaccgc 1080
agctacttct atgccacggc ggtggccgac ctggcggccg aactgcaggc ccgcacgggc 1140
tattga                                                          1146
```

<210> 72
<211> 381
<212> PRT
<213> Bordetella pertussis

<400> 72
```
Met Phe Asn Cys Arg Arg Phe Leu Gln Ile Gly Thr Leu Ser Ala Leu
 1               5                  10                  15
Leu Ala Gly Cys Ala Thr Ser Ser Gln Thr Pro Gln Ala Gln His Leu
            20                  25                  30
Pro Ala Gln Ala Ala Thr Gly Gln Ala Asp Arg Val Arg Ile Gly Pro
        35                  40                  45
Asp Lys Pro Val Ser Ser Asp Glu Gly Pro Ala Thr Leu Thr Pro Thr
    50                  55                  60
Gly Glu Leu Arg Pro Asp Val Arg Ala Phe Ala Glu Gln Leu Ala Ala
65                  70                  75                  80
Gln Arg Glu Leu Pro Leu Pro Gln Val Leu Ala Ser Leu Glu Ser Thr
                85                  90                  95
Arg Tyr Asn Ala Thr Val Ala Arg Leu Ile Ala Pro Ser Gly Ala Ser
            100                 105                 110
Gly Lys Lys Ile Trp Arg Ser Trp Leu Thr Tyr Arg Gly Arg Phe Val
        115                 120                 125
Glu Pro Lys Arg Ile Ala Trp Gly Val Glu Phe Trp Asn Ala Asn Gln
    130                 135                 140
Asp Leu Leu Asn Arg Ala Ala Gln Arg Tyr Gly Val Pro Ala Ser Ile
145                 150                 155                 160
Ile Ala Ser Ile Ile Gly Val Glu Thr Leu Tyr Gly Arg Asn Val Gly
                165                 170                 175
```

```
Asn Phe Arg Val Val Asp Ala Leu Ala Thr Leu Ala Phe Asp Tyr Leu
            180                 185                 190
Asp Pro Ala Lys Pro Glu Arg Ala Asp Met Phe Arg Gly Gln Leu Gly
        195                 200                 205
Asp Phe Ile Thr Leu Ala Leu Gln Asp Lys Leu Asp Pro Glu Thr Arg
    210                 215                 220
Gly Ser Tyr Ala Gly Ala Ile Gly Met Pro Gln Phe Met Pro Gly Ser
225                 230                 235                 240
Ile Met Arg Tyr Ala Val Asp Gly Asp Asp Asp Gly His Ile Asp Leu
                245                 250                 255
Thr Asn Ser Val Ala Asp Ala Val Met Ser Val Gly Asn Phe Leu Val
            260                 265                 270
Glu His Gly Trp Gln Arg Gly Leu Pro Val Phe Ala Pro Val Ala Leu
        275                 280                 285
Pro Ala Asp Pro Ala Pro Leu Val Ala Gly Gly Leu Thr Pro Thr Leu
    290                 295                 300
Asp Trp Asn Gly Leu Gln Ala Ala Gly Ala Arg Pro Ala Ala Gly Ala
305                 310                 315                 320
Gly Arg Gly Ala Trp Gln Glu His Pro Met Gly Ile Val Asp Leu Val
                325                 330                 335
Glu Glu Ala Arg Gly Thr Val Gln Tyr Arg Thr Ala Thr Pro Asn Phe
            340                 345                 350
Phe Ala Leu Thr Gln Tyr Asn Arg Ser Tyr Phe Tyr Ala Thr Ala Val
        355                 360                 365
Ala Asp Leu Ala Ala Glu Leu Gln Ala Arg Thr Gly Tyr
    370                 375                 380
```

<210> 73
<211> 1098
<212> DNA
<213> Bordetella pertussis

<400> 73
atgaaccata gactcatacg ttgcctgagc atcgcgctgc tggccctgct gtcgggctgc 60
agcattctct ccgggtcggg cccgacgcga tcggccatca tggacggcgg gtcgaccgac 120
gcgaccggcg ccaagctcgg ctcctacgac ctggtggacc tgcgcgccga caccattgcg 180
ccctatgtgc tggtcaaggc ggtgtccaag gatggcgcca cctcggacgg ctacgtgggc 240
aatatgcgcg tgatgccggg cgatgtgctg cgcatcctgg tagccgacag catggagacc 300
ggactgttcg cgccgctggc cgccggcggc acggtgttcg aagccgtgcg ggtcgcggcc 360
gacggcagca tctcgctgcc ctatgcgggc cgcctgaaag tgcagggcaa gtcgctggcg 420
cagatcgagc agctcgtcaa gggcagcctg cgcaataccg cggcggtgca gccgcaggcc 480
atggtggatc tggccgacga ccgctccaat tcggtgctgg tggccggggc ggtgccgcgc 540
ccgggacgct tcggcggcaa caagggcccg ctgacggcgc tggatgcgat cacgcaggcg 600
ggcggctcga ccctgccggc ttaccaggcc gacgtagtga tccggactgg cagcaaggtg 660
cagcgcattc cttaccagca attgctcaac ggccgcaacg tggcggtgga gccgcgctcc 720
gaactggtgg tcgaaccgaa cctgaagcgt ttcgtggcga tgggggccct taccaagccg 780
ggcctgcacg aactgccgtc gaaccagacc aatctgctcg acgccctggg cgtggccgga 840
ggcctgaacg accgcgcggc cgacgccacc ggggtattcg tttttcgcct ggacggccgc 900
aacgccgatg gccgcccgcg gcccacggtg ttcaggctga atatgcgcaa tccggagtcc 960
atgttcctgg ccaagcaatt cgagctgctg ccggaggacg tggtgtatgt cagtaatgcg 1020
cccatgtacg aatgggaaaa gatcattacg cctatcgtgc aggtcctgat cgtgggccaa 1080
cgcgtgggta cttactaa   1098

<210> 74
<211> 365
<212> PRT
<213> Bordetella pertussis

<400> 74
Met Asn His Arg Leu Ile Arg Cys Leu Ser Ile Ala Leu Leu Ala Leu

```
 1               5                  10                  15
Leu Ser Gly Cys Ser Ile Leu Ser Gly Ser Gly Pro Thr Arg Ser Ala
            20                  25                  30
Ile Met Asp Gly Gly Ser Thr Asp Ala Thr Gly Ala Lys Leu Gly Ser
        35                  40                  45
Tyr Asp Leu Val Asp Leu Arg Ala Asp Thr Ile Ala Pro Tyr Val Leu
    50                  55                  60
Val Lys Ala Val Ser Lys Asp Gly Ala Thr Ser Asp Gly Tyr Val Gly
65                  70                  75                  80
Asn Met Arg Val Met Pro Gly Asp Val Leu Arg Ile Leu Val Ala Asp
                85                  90                  95
Ser Met Glu Thr Gly Leu Phe Ala Pro Leu Ala Ala Gly Gly Thr Val
            100                 105                 110
Phe Glu Ala Val Arg Val Ala Ala Asp Gly Ser Ile Ser Leu Pro Tyr
        115                 120                 125
Ala Gly Arg Leu Lys Val Gln Gly Lys Ser Leu Ala Gln Ile Glu Gln
    130                 135                 140
Leu Val Lys Gly Ser Leu Arg Asn Thr Ala Ala Val Gln Pro Gln Ala
145                 150                 155                 160
Met Val Asp Leu Ala Asp Asp Arg Ser Asn Ser Val Leu Val Ala Gly
                165                 170                 175
Ala Val Pro Arg Pro Gly Arg Phe Gly Gly Asn Lys Gly Pro Leu Thr
            180                 185                 190
Ala Leu Asp Ala Ile Thr Gln Ala Gly Gly Ser Thr Leu Pro Ala Tyr
        195                 200                 205
Gln Ala Asp Val Val Ile Arg Thr Gly Ser Lys Val Gln Arg Ile Pro
    210                 215                 220
Tyr Gln Gln Leu Leu Asn Gly Arg Asn Val Ala Val Glu Pro Arg Ser
225                 230                 235                 240
Glu Leu Val Val Glu Pro Asn Leu Lys Arg Phe Val Ala Met Gly Ala
                245                 250                 255
Leu Thr Lys Pro Gly Leu His Glu Leu Pro Ser Asn Gln Thr Asn Leu
            260                 265                 270
Leu Asp Ala Leu Gly Val Ala Gly Gly Leu Asn Asp Arg Ala Ala Asp
        275                 280                 285
Ala Thr Gly Val Phe Val Phe Arg Leu Asp Gly Arg Asn Ala Asp Gly
    290                 295                 300
Arg Pro Arg Pro Thr Val Phe Arg Leu Asn Met Arg Asn Pro Glu Ser
305                 310                 315                 320
Met Phe Leu Ala Lys Gln Phe Glu Leu Leu Pro Glu Asp Val Val Tyr
                325                 330                 335
Val Ser Asn Ala Pro Met Tyr Glu Trp Glu Lys Ile Ile Thr Pro Ile
            340                 345                 350
Val Gln Val Leu Ile Val Gly Gln Arg Val Gly Thr Tyr
        355                 360                 365
```

<210> 75
<211> 900
<212> DNA
<213> Bordetella pertussis

<400> 75
atgcaacgtc tcatgcccat cctggtcgga ctgctcgtcg tcctggccgt cctgtcttca 60
tgcgtcttcg tggtccgcga gcgcgactac gccctggtgt tctcgctggg cgaggtgcgc 120
caggtcatca gcgagcctgg cctgtatttc aaggcgccgc cgccgttcca gaacgtcgtc 180
acgctggaca agcgcatcct caccatcgag tccagcgatg ccgagcgcat ccagacctcc 240
gagaagaaga acctgctgat cgactcgtac gtcaagtggc gcatcgccga tccgcgcctg 300
tactacgtga ccttcggcgg caacgagcgc gccgcccagg agcgtctgca ggcgcagatc 360
cgcgacgcgc tgaacgcggc ggtcaacgtg cgcacggtca aggacgtggt ctcggccgag 420
cgtgacaagg tcatggccga aatcctcacc aacgtcgtca agcgcgccga gccgctgggc 480

gtgcaggtgg tcgacgtgcg cctgcgccgc atcgagttcg cgcccgagat ttccgagtcg 540
gtctatcgcc gcatggaagc cgagcgcacc cgcgtggcca acgagctgcg ttcgatcggc 600
gcggccgaaa gcgagaagat ccgcgccgag gccgaccgcc agcgcgaggt catcgtggcc 660
caggcctatg cgcgcgccca gggcatcatg ggcgagggcg acgcccaggc cggcagcatc 720
tacgcccagg ccttcggccg caataccgag ttctacacct attacaagag cctggaagcc 780
tatcgcgccg cgttcggcaa aaccggtgac gtattggtgg tcgatccgac gtcggagttc 840
ttccagttct tcaagaaccc cggcaagggc gcggcgggcg ccccggcacc ggcgaattga 900

<210> 76
<211> 299
<212> PRT
<213> Bordetella pertussis

<400> 76
Met Gln Arg Leu Met Pro Ile Leu Val Gly Leu Leu Val Val Leu Ala
1 5 10 15
Val Leu Ser Ser Cys Val Phe Val Val Arg Glu Arg Asp Tyr Ala Leu
20 25 30
Val Phe Ser Leu Gly Glu Val Arg Gln Val Ile Ser Glu Pro Gly Leu
35 40 45
Tyr Phe Lys Ala Pro Pro Pro Phe Gln Asn Val Val Thr Leu Asp Lys
50 55 60
Arg Ile Leu Thr Ile Glu Ser Ser Asp Ala Glu Arg Ile Gln Thr Ser
65 70 75 80
Glu Lys Lys Asn Leu Leu Ile Asp Ser Tyr Val Lys Trp Arg Ile Ala
85 90 95
Asp Pro Arg Leu Tyr Tyr Val Thr Phe Gly Gly Asn Glu Arg Ala Ala
100 105 110
Gln Glu Arg Leu Gln Ala Gln Ile Arg Asp Ala Leu Asn Ala Ala Val
115 120 125
Asn Val Arg Thr Val Lys Asp Val Val Ser Ala Glu Arg Asp Lys Val
130 135 140
Met Ala Glu Ile Leu Thr Asn Val Val Lys Arg Ala Glu Pro Leu Gly
145 150 155 160
Val Gln Val Val Asp Val Arg Leu Arg Arg Ile Glu Phe Ala Pro Glu
165 170 175
Ile Ser Glu Ser Val Tyr Arg Arg Met Glu Ala Glu Arg Thr Arg Val
180 185 190
Ala Asn Glu Leu Arg Ser Ile Gly Ala Ala Glu Ser Glu Lys Ile Arg
195 200 205
Ala Glu Ala Asp Arg Gln Arg Glu Val Ile Val Ala Gln Ala Tyr Ala
210 215 220
Arg Ala Gln Gly Ile Met Gly Glu Gly Asp Ala Gln Ala Gly Ser Ile
225 230 235 240
Tyr Ala Gln Ala Phe Gly Arg Asn Thr Glu Phe Tyr Thr Tyr Tyr Lys
245 250 255
Ser Leu Glu Ala Tyr Arg Ala Ala Phe Gly Lys Thr Gly Asp Val Leu
260 265 270
Val Val Asp Pro Thr Ser Glu Phe Phe Gln Phe Phe Lys Asn Pro Gly
275 280 285
Lys Gly Ala Ala Gly Ala Pro Ala Pro Ala Asn
290 295

<210> 77
<211> 855
<212> DNA
<213> Bordetella pertussis

<400> 77

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ttgcccaggg aggcaaccat gaaacccgtc atccagactt tcctgcgcgc cgccgccgtg 60
gccggcctgg cgctgctggc cggctgcgcc ggcgtcagca cgacgcagtc cggcgcgatc 120
ggcgtggacc gcacccaata catgtcgagc ctggtgcccg agcaggcgct ggtgcaggag 180
gccgggcagc agtatgccga gatcgtccag gaggcccgcg ccaaggggct gcttgaccgc 240
gacccggcgc aattgtcgcg cgtgcgcgcc atttcccagc gcctgatcgc gcagaccggg 300
gtgtttcgcg ccgacgcggc caactggcca tgggaagtgc atgtgctgtc ggtcgacgag 360
gtcaacgcct ggtgcatgcc cggcggcaag attgccgtct acacgggcct gctcgcccat 420
atcaagccga ccgacgacga actggcggcg gtgctgggcc acgagatcgc gcatgcgttg 480
cgcgagcacg cgcgcgagcg cgtctcgcag cagatggcga ccagcatcgg cctgtcggtg 540
ctgtccatgg ccaccggttc gcccggcgcg tccgacctgg gcggcaagct gaccgaagtc 600
atgttcacct tgcccaacag ccgcacgcac gagaccgagg ccgatcgcat gggcgtcgaa 660
ctggccgcgc gcgccggttt cgatccgcgc gccgccgtca cgctgtggca gaaaatgggc 720
gcggccgacg gcaatgcgcc gccggagttc ctgtccaccc acccgtcggc cagtacccgc 780
atcggcgaat tgcagcaggc cttgcagaag gtattgccgc tgtacgagca ggcgcgcggc 840
caggccgcca aatag                                                  855
```

<210> 78
<211> 284
<212> PRT
<213> Bordetella pertussis

<400> 78

```
Leu Pro Arg Glu Ala Thr Met Lys Pro Val Ile Gln Thr Phe Leu Arg
 1               5                  10                  15
Ala Ala Ala Val Ala Gly Leu Ala Leu Leu Ala Gly Cys Ala Gly Val
            20                  25                  30
Ser Thr Thr Gln Ser Gly Ala Ile Gly Val Asp Arg Thr Gln Tyr Met
        35                  40                  45
Ser Ser Leu Val Pro Glu Gln Ala Leu Val Gln Glu Ala Gly Gln Gln
    50                  55                  60
Tyr Ala Glu Ile Val Gln Glu Ala Arg Ala Lys Gly Leu Leu Asp Arg
65                  70                  75                  80
Asp Pro Ala Gln Leu Ser Arg Val Arg Ala Ile Ser Gln Arg Leu Ile
                85                  90                  95
Ala Gln Thr Gly Val Phe Arg Ala Asp Ala Ala Asn Trp Pro Trp Glu
            100                 105                 110
Val His Val Leu Ser Val Asp Glu Val Asn Ala Trp Cys Met Pro Gly
        115                 120                 125
Gly Lys Ile Ala Val Tyr Thr Gly Leu Leu Ala His Ile Lys Pro Thr
    130                 135                 140
Asp Asp Glu Leu Ala Ala Val Leu Gly His Glu Ile Ala His Ala Leu
145                 150                 155                 160
Arg Glu His Ala Arg Glu Arg Val Ser Gln Gln Met Ala Thr Ser Ile
                165                 170                 175
Gly Leu Ser Val Leu Ser Met Ala Thr Gly Ser Pro Gly Ala Ser Asp
            180                 185                 190
Leu Gly Gly Lys Leu Thr Glu Val Met Phe Thr Leu Pro Asn Ser Arg
        195                 200                 205
Thr His Glu Thr Glu Ala Asp Arg Met Gly Val Glu Leu Ala Ala Arg
    210                 215                 220
Ala Gly Phe Asp Pro Arg Ala Ala Val Thr Leu Trp Gln Lys Met Gly
225                 230                 235                 240
Ala Ala Asp Gly Asn Ala Pro Pro Glu Phe Leu Ser Thr His Pro Ser
                245                 250                 255
Ala Ser Thr Arg Ile Gly Glu Leu Gln Gln Ala Leu Gln Lys Val Leu
            260                 265                 270
Pro Leu Tyr Glu Gln Ala Arg Gly Gln Ala Ala Lys
        275                 280
```

<210> 79
<211> 849
<212> DNA
<213> Bordetella pertussis

<400> 79
gtgactcacc gtcccgctgc actctcgaag cccgcctccc gccgcggggt ggccctgcgc 60
gcggcgatcg cgctgtcaac cattctgatc gtggccggct gcggctcgtc aagcaccaaa 120
tacgacaaga ccgcgggctg gagcgccgaa cagttgtacg ccgacgccaa gcaggaagtc 180
gcggcgggca actggaccga tgcccgggag cgcctgaccg ccatcgaaag ccgctacccg 240
ttcggcacgt acgcccagca ggccctgatc gaactggctt acgtcaactg gaaagacggc 300
gagaacgaac aggcgctggc cgccatcgac cgcttccagc agctctatcc caaccacccg 360
ggcacggact acgtgctgta cctgaagggg ctggtcaact tcacgccggc cagcgccttc 420
atgagcaacc tgaccggcca ggaccccgcc gagcgcgatc ccaagggcct gcgcgcgtcc 480
tacgatgcgt tcaacgaact ggtccagcgc ttccccaaca gcaagtacac gcccgatgcg 540
cagaagcgca tgacctggct ggtcaacgcc atcgccatga acgaagtcca cgtggcgcgc 600
tactactacg agcggggcgc ctacgtggcg gccgccaacc gggcgcagac cgtgatcacc 660
gatttcgagg gggcccccgc ctcggaagaa gcgctctata tcatggtcga gtcgtatgac 720
aagctgggaa tgaccgaact gaagggcgac gccgaacgcg tgctcgacca gaactatccc 780
aacagcaaat tcaagacgca aggcctgtcg gccgacaaga gctggtggaa cccgttctcg 840
tggcgctga 849

<210> 80
<211> 282
<212> PRT
<213> Bordetella pertussis

<400> 80
Val Thr His Arg Pro Ala Ala Leu Ser Lys Pro Ala Ser Arg Arg Gly
 1   5   10   15
Val Ala Leu Arg Ala Ala Ile Ala Leu Ser Thr Ile Leu Ile Val Ala
            20   25   30
Gly Cys Gly Ser Ser Ser Thr Lys Tyr Asp Lys Thr Ala Gly Trp Ser
        35   40   45
Ala Glu Gln Leu Tyr Ala Asp Ala Lys Gln Glu Val Ala Ala Gly Asn
    50   55   60
Trp Thr Asp Ala Arg Glu Arg Leu Thr Ala Ile Glu Ser Arg Tyr Pro
65   70   75   80
Phe Gly Thr Tyr Ala Gln Gln Ala Leu Ile Glu Leu Ala Tyr Val Asn
                85   90   95
Trp Lys Asp Gly Glu Asn Glu Gln Ala Leu Ala Ala Ile Asp Arg Phe
            100   105   110
Gln Gln Leu Tyr Pro Asn His Pro Gly Thr Asp Tyr Val Leu Tyr Leu
        115   120   125
Lys Gly Leu Val Asn Phe Thr Pro Ala Ser Ala Phe Met Ser Asn Leu
    130   135   140
Thr Gly Gln Asp Pro Ala Glu Arg Asp Pro Lys Gly Leu Arg Ala Ser
145   150   155   160
Tyr Asp Ala Phe Asn Glu Leu Val Gln Arg Phe Pro Asn Ser Lys Tyr
                165   170   175
Thr Pro Asp Ala Gln Lys Arg Met Thr Trp Leu Val Asn Ala Ile Ala
            180   185   190
Met Asn Glu Val His Val Ala Arg Tyr Tyr Tyr Glu Arg Gly Ala Tyr
        195   200   205
Val Ala Ala Ala Asn Arg Ala Gln Thr Val Ile Thr Asp Phe Glu Gly
    210   215   220
Ala Pro Ala Ser Glu Glu Ala Leu Tyr Ile Met Val Glu Ser Tyr Asp
225   230   235   240
Lys Leu Gly Met Thr Glu Leu Lys Gly Asp Ala Glu Arg Val Leu Asp
                245   250   255
Gln Asn Tyr Pro Asn Ser Lys Phe Lys Thr Gln Gly Leu Ser Ala Asp

```
            260                 265                 270
Lys Ser Trp Trp Asn Pro Phe Ser Trp Arg
        275                 280
```

<210> 81
<211> 816
<212> DNA
<213> Bordetella pertussis

<400> 81
ttgcccccac aggttgacct tgccatgacg aagcactctg ccgctcgaat cgccaccatc 60
gccgccgcag gcgtcctgct ggccggctgc gcagcgccca agaaccccga tccgcgcgat 120
ccctgggaag gcttcaaccg gggcgtctac aagttcaacg acacggtcga ccgcgcgctg 180
ttcaagccgg tggcccaggc ctataccttc gtcaccccgc agccggtgcg cagctgcgtg 240
cacaatatgt tcagcaacgt gggcgacctg tggtcggcca ccaacagctt cctgcaaggc 300
cgcgggcacg atttcgtcaa cacgatcggc cgcttcctgt tcaataccac catggggatc 360
ggcggctgct tcgacgtcgc gtcgaccacc ggggcgcgca agatccccaa cgacttcggc 420
gtgacgctgg gcgtctgggg cttcggccag ggaccgtacc tggtgctgcc gatctggggc 480
gccagcagcc tgcgcgacgg cgtcggcctg atcggcgact ggaccggcaa ccagggcgcg 540
accatcggcg cgatcgacaa cgtgccgctg cgcaactcgc tgtggggcct ggaggccgtc 600
gacctgcgcg ccagcctgct cgataccacc gacaccgtgg accgcgtggc gctggatccc 660
tacagcttcg tgcgcgacgc ctacctgcag cgccgcgccg ccatggtgcg cggcaccaag 720
acgggcgacg acacgctgcc cacctatgaa gacgagggcg atgacgacgc ggcccccgcc 780
gcgccggccg cccagccggc cgcccagccg cagtaa 816

<210> 82
<211> 271
<212> PRT
<213> Bordetella pertussis

<400> 82
```
Leu Pro Pro Gln Val Asp Leu Ala Met Thr Lys His Ser Ala Ala Arg
 1               5                  10                  15
Ile Ala Thr Ile Ala Ala Ala Gly Val Leu Leu Ala Gly Cys Ala Ala
            20                  25                  30
Pro Lys Asn Pro Asp Pro Arg Asp Pro Trp Glu Gly Phe Asn Arg Gly
        35                  40                  45
Val Tyr Lys Phe Asn Asp Thr Val Asp Arg Ala Leu Phe Lys Pro Val
    50                  55                  60
Ala Gln Ala Tyr Thr Phe Val Thr Pro Gln Pro Val Arg Ser Cys Val
65                  70                  75                  80
His Asn Met Phe Ser Asn Val Gly Asp Leu Trp Ser Ala Thr Asn Ser
                85                  90                  95
Phe Leu Gln Gly Arg Gly His Asp Phe Val Asn Thr Ile Gly Arg Phe
            100                 105                 110
Leu Phe Asn Thr Thr Met Gly Ile Gly Gly Cys Phe Asp Val Ala Ser
        115                 120                 125
Thr Thr Gly Ala Arg Lys Ile Pro Asn Asp Phe Gly Val Thr Leu Gly
    130                 135                 140
Val Trp Gly Phe Gly Gln Gly Pro Tyr Leu Val Leu Pro Ile Trp Gly
145                 150                 155                 160
Ala Ser Ser Leu Arg Asp Gly Val Gly Leu Ile Gly Asp Trp Thr Gly
                165                 170                 175
Asn Gln Gly Ala Thr Ile Gly Ala Ile Asp Asn Val Pro Leu Arg Asn
            180                 185                 190
Ser Leu Trp Gly Leu Glu Ala Val Asp Leu Arg Ala Ser Leu Leu Asp
        195                 200                 205
Thr Thr Asp Thr Val Asp Arg Val Ala Leu Asp Pro Tyr Ser Phe Val
    210                 215                 220
Arg Asp Ala Tyr Leu Gln Arg Arg Ala Ala Met Val Arg Gly Thr Lys
```

```
225                 230                 235                 240
Thr Gly Asp Asp Thr Leu Pro Thr Tyr Glu Asp Glu Gly Asp Asp Asp
                245                 250                 255
Ala Ala Pro Ala Ala Pro Ala Ala Gln Pro Ala Ala Gln Pro Gln
            260                 265                 270
```

<210> 83
<211> 804
<212> DNA
<213> Bordetella pertussis

<400> 83
atggcaacaa agtgcctgct ccaggggagt tttccggatg ccagcccgat aatgccggca 60
atgcgtagtg gcgccgcatg ggtgctggaa gggaggttta tgcggtttgg atggggattg 120
ccggcgctgg ccgtcgtgct tgcgctggcc ggatgcgtga atcgcgagcc agaggagcgc 180
gcggccttca tcgcgtatct ggaacaagtg gccgcgccgc aggcgggcgt cgtggccgcg 240
ccgcccgacc cgcccacgcg caaggccctg ggcgactacg aggcgcagta cgagccgatg 300
gaagcggcgc acgccgccgt gcgcgaagcg ttggcggcgc agcaggcggc gctgcaggcg 360
ctgcggctgc attcggtcga cgagatcgtc gcacgccagg acggctggga caggctggcc 420
gagcgcctgg cggccgcgcg caccgggctc gaacaggcgc gcgccgccgc cgacgccgcg 480
cgcgccggga tggagcagcc tcccgacctg cgcaacgcct acgcgcgcgc ctatgaacac 540
agcgtcacgg cgccggcaca ggccttggcg cggatatccg gcctgctcga acccgccgtg 600
gaggatgcgc ggcgcgtggc cgggttcgtt gcgcgccatc gcgatcaggt cgataccgat 660
ggtccgctga cccaggtgcg cgatccctcg gtgcgcagcg agctcaatgt actgctgcag 720
gcgctcaatg gccgctccga ccaggtttcg caggcgcagg ccttgctcaa tggcctggcg 780
ggaccggctc gccaggcgcc ctga 804

<210> 84
<211> 267
<212> PRT
<213> Bordetella pertussis

<400> 84
```
Met Ala Thr Lys Cys Leu Leu Gln Gly Ser Phe Pro Asp Ala Ser Pro
 1               5                  10                  15
Ile Met Pro Ala Met Arg Ser Gly Ala Ala Trp Val Leu Glu Gly Arg
            20                  25                  30
Phe Met Arg Phe Gly Trp Gly Leu Pro Ala Leu Ala Val Val Leu Ala
        35                  40                  45
Leu Ala Gly Cys Val Asn Arg Glu Pro Glu Glu Arg Ala Ala Phe Ile
    50                  55                  60
Ala Tyr Leu Glu Gln Val Ala Ala Pro Gln Ala Gly Val Val Ala Ala
65                  70                  75                  80
Pro Pro Asp Pro Pro Thr Arg Lys Ala Leu Gly Asp Tyr Glu Ala Gln
                85                  90                  95
Tyr Glu Pro Met Glu Ala Ala His Ala Ala Val Arg Glu Ala Leu Ala
            100                 105                 110
Ala Gln Gln Ala Ala Leu Gln Ala Leu Arg Leu His Ser Val Asp Glu
        115                 120                 125
Ile Val Ala Arg Gln Asp Gly Trp Asp Arg Leu Ala Glu Arg Leu Ala
    130                 135                 140
Ala Ala Arg Thr Gly Leu Glu Gln Ala Arg Ala Ala Ala Asp Ala Ala
145                 150                 155                 160
Arg Ala Gly Met Glu Gln Pro Pro Asp Leu Arg Asn Ala Tyr Ala Arg
                165                 170                 175
Ala Tyr Glu His Ser Val Thr Ala Pro Ala Gln Ala Leu Ala Arg Ile
            180                 185                 190
Ser Gly Leu Leu Glu Pro Ala Val Glu Asp Ala Arg Arg Val Ala Gly
        195                 200                 205
Phe Val Ala Arg His Arg Asp Gln Val Asp Thr Asp Gly Pro Leu Thr
```

```
    210                 215                 220
Gln Val Arg Asp Pro Ser Val Arg Ser Glu Leu Asn Val Leu Leu Gln
225                 230                 235                 240
Ala Leu Asn Gly Arg Ser Asp Gln Val Ser Gln Ala Gln Ala Leu Leu
                245                 250                 255
Asn Gly Leu Ala Gly Pro Ala Arg Gln Ala Pro
            260                 265
```

<210> 85
<211> 693
<212> DNA
<213> Bordetella pertussis

<400> 85
gtgatgctga agaccgtatt gcgcctgccg gtctgcgccg cgctgctggc gctggccgcg 60
ggctgcgcga tgattccgcc cgaaccggtg gtgatctgtc cgctgaccgc gccgcctccg 120
tcgccgccgc aaccctcggc gcggcccaac ggctcgatct accagccttc ggcctacggc 180
aactatccgc tgttcgagga ccgccggccg cgcaacgtgg gcgacatcgt caccatcgtg 240
ctggaggaaa agaccaacgc cgccaagggc gtggccacca ataccagccg cgacggctcg 300
gccacgctgg gcgtggcggc cgcgccgcgc ttcatggacg gcatcatcaa cgacaagctg 360
gataccgata tctcgggcgg caataccgcc aacggcaccg gcaagagcag cgccaacaac 420
accttcaccg gcaccatcac gaccaccgtg atcggggtgc tgcccaacgg caatctgcag 480
atcgccggcg agaagcagat cgccatcaac cgcggcagcg agtacgtgcg cttctcgggc 540
gtggtcgacc cgcgatcgat caccggcagc aatacggtgt cgtcgacccg ggtggccgac 600
gcgcgcatcg aataccgcag caagggcgtc atggacgaag tccagaccat gggctggctg 660
caacgctttt tcctgatcgc ttcgccgttc tga 693

<210> 86
<211> 230
<212> PRT
<213> Bordetella pertussis

<400> 86
```
Val Met Leu Lys Thr Val Leu Arg Leu Pro Val Cys Ala Ala Leu Leu
 1               5                  10                  15
Ala Leu Ala Ala Gly Cys Ala Met Ile Pro Pro Glu Pro Val Val Ile
            20                  25                  30
Cys Pro Leu Thr Ala Pro Pro Pro Ser Pro Pro Gln Pro Ser Ala Arg
        35                  40                  45
Pro Asn Gly Ser Ile Tyr Gln Pro Ser Ala Tyr Gly Asn Tyr Pro Leu
    50                  55                  60
Phe Glu Asp Arg Arg Pro Arg Asn Val Gly Asp Ile Val Thr Ile Val
65                  70                  75                  80
Leu Glu Glu Lys Thr Asn Ala Ala Lys Gly Val Ala Thr Asn Thr Ser
                85                  90                  95
Arg Asp Gly Ser Ala Thr Leu Gly Val Ala Ala Ala Pro Arg Phe Met
            100                 105                 110
Asp Gly Ile Ile Asn Asp Lys Leu Asp Thr Asp Ile Ser Gly Gly Asn
        115                 120                 125
Thr Ala Asn Gly Thr Gly Lys Ser Ser Ala Asn Asn Thr Phe Thr Gly
    130                 135                 140
Thr Ile Thr Thr Thr Val Ile Gly Val Leu Pro Asn Gly Asn Leu Gln
145                 150                 155                 160
Ile Ala Gly Glu Lys Gln Ile Ala Ile Asn Arg Gly Ser Glu Tyr Val
                165                 170                 175
Arg Phe Ser Gly Val Val Asp Pro Arg Ser Ile Thr Gly Ser Asn Thr
            180                 185                 190
Val Ser Ser Thr Arg Val Ala Asp Ala Arg Ile Glu Tyr Arg Ser Lys
        195                 200                 205
Gly Val Met Asp Glu Val Gln Thr Met Gly Trp Leu Gln Arg Phe Phe
```

```
    210                 215                 220
Leu Ile Ala Ser Pro Phe
225                 230
```

<210> 87
<211> 681
<212> DNA
<213> Bordetella pertussis

<400> 87
atgaagtcgt ccctgtatcg aatcgcagcg ctcagcgccg ctgccctgtt gctggccggc 60
tgcgccaacc agcgcgctcc gaaggagtcg ggcttcctcg gcgattactc gcagttgcgc 120
gaggagcagg tgcccggcgg cgcgcggctg atctaccgcg acgccgcgct caagccgcgc 180
cagtacaccg ccatgtggct gtcgccggtc gagtactacc ccagcccgca accgtcggcg 240
caggtgtcga tggaaacgct gaccgaactg cagaactacc tggaccagtc gctgcgccgc 300
aagatcggcc gcgagatccg cctggtcaac ggccccggcc cgggcgtggc caaggcgcgc 360
atcgcgatca cagcggtcgg cagcgaaagc gaggcgctgg cggcctacca gtacatcccc 420
gtggcgctgg ccgtcaccgg cgccagggcc gtgctggaag gcggccggcc gcagcaggcc 480
accatcgcga tcgaaagcaa ggtcaccgac agccagacgg gccagctgct gtgggcgtcg 540
gtgcgcgggg gcaccggcga gcgcgtacgc gccatcgccc agggccaggc ctcggtgccg 600
gcctcggcgc tcaagccgct gatcgacgaa tggaccgata acgtcgcacg tgaaatacgc 660
aactacgtgc gcagcaaata a   681

<210> 88
<211> 226
<212> PRT
<213> Bordetella pertussis

<400> 88
```
Met Lys Ser Ser Leu Tyr Arg Ile Ala Ala Leu Ser Ala Ala Ala Leu
 1               5                  10                  15
Leu Leu Ala Gly Cys Ala Asn Gln Arg Ala Pro Lys Glu Ser Gly Phe
            20                  25                  30
Leu Gly Asp Tyr Ser Gln Leu Arg Glu Glu Gln Val Pro Gly Gly Ala
        35                  40                  45
Arg Leu Ile Tyr Arg Asp Ala Ala Leu Lys Pro Arg Gln Tyr Thr Ala
    50                  55                  60
Met Trp Leu Ser Pro Val Glu Tyr Tyr Pro Ser Pro Gln Pro Ser Ala
65                  70                  75                  80
Gln Val Ser Met Glu Thr Leu Thr Glu Leu Gln Asn Tyr Leu Asp Gln
                85                  90                  95
Ser Leu Arg Arg Lys Ile Gly Arg Glu Ile Arg Leu Val Asn Gly Pro
            100                 105                 110
Gly Pro Gly Val Ala Lys Ala Arg Ile Ala Ile Thr Ala Val Gly Ser
        115                 120                 125
Glu Ser Glu Ala Leu Ala Ala Tyr Gln Tyr Ile Pro Val Ala Leu Ala
    130                 135                 140
Val Thr Gly Ala Arg Ala Val Leu Glu Gly Gly Arg Pro Gln Gln Ala
145                 150                 155                 160
Thr Ile Ala Ile Glu Ser Lys Val Thr Asp Ser Gln Thr Gly Gln Leu
                165                 170                 175
Leu Trp Ala Ser Val Arg Gly Gly Thr Gly Glu Arg Val Arg Ala Ile
            180                 185                 190
Ala Gln Gly Gln Ala Ser Val Pro Ala Ser Ala Leu Lys Pro Leu Ile
        195                 200                 205
Asp Glu Trp Thr Asp Asn Val Ala Arg Glu Ile Arg Asn Tyr Val Arg
    210                 215                 220
Ser Lys
225
```

<210> 89
<211> 561
<212> DNA
<213> Bordetella pertussis

<400> 89
gtgaaccaac gtggggccct tttacccgtt aacacgtgtg actctctttg caaaggaact 60
atcatgaagt cgcgcattgc caaaagccta accatagctg cgctggccgc cacgctggca 120
gcctgcagtt ccgtccctct cgacgacaag gcaggtcaag ctggaggctc cggccagggt 180
tcggcctccg gccagatcct ggatcccttc aacccgcaaa gcattctggc gcaacagcgc 240
tcggtgtact ttgacttcga cagctatacg gtgtcggaac agtatcgcgg cctggtcgaa 300
acccacgccc gctacctggc ttcgaacaac cagcagcgca tcaagatcga aggcaatacc 360
gacgaacgcg gcggcgccga gtacaacctc gcactgggcc aacgccgtgc cgacgctgtc 420
cgtcgcatga tgaccctgct gggtgtgtcg gacaaccaga tcgaaaccat tagtttcggc 480
aaggaaaagc cgaaggcgac gggttcgagc gaggctgatt tcgccgagaa ccgccgcgcc 540
gatatcgttt atcagcgcta a 561

<210> 90
<211> 186
<212> PRT
<213> Bordetella pertussis

<400> 90
Val Asn Gln Arg Gly Ala Leu Leu Pro Val Asn Thr Cys Asp Ser Leu
 1   5   10   15
Cys Lys Gly Thr Ile Met Lys Ser Arg Ile Ala Lys Ser Leu Thr Ile
            20   25   30
Ala Ala Leu Ala Ala Thr Leu Ala Ala Cys Ser Ser Val Pro Leu Asp
        35   40   45
Asp Lys Ala Gly Gln Ala Gly Gly Ser Gly Gln Gly Ser Ala Ser Gly
    50   55   60
Gln Ile Leu Asp Pro Phe Asn Pro Gln Ser Ile Leu Ala Gln Gln Arg
65   70   75   80
Ser Val Tyr Phe Asp Phe Asp Ser Tyr Thr Val Ser Glu Gln Tyr Arg
                85   90   95
Gly Leu Val Glu Thr His Ala Arg Tyr Leu Ala Ser Asn Asn Gln Gln
            100   105   110
Arg Ile Lys Ile Glu Gly Asn Thr Asp Glu Arg Gly Gly Ala Glu Tyr
        115   120   125
Asn Leu Ala Leu Gly Gln Arg Arg Ala Asp Ala Val Arg Arg Met Met
    130   135   140
Thr Leu Leu Gly Val Ser Asp Asn Gln Ile Glu Thr Ile Ser Phe Gly
145   150   155   160
Lys Glu Lys Pro Lys Ala Thr Gly Ser Ser Glu Ala Asp Phe Ala Glu
                165   170   175
Asn Arg Arg Ala Asp Ile Val Tyr Gln Arg
            180   185

<210> 91
<211> 555
<212> DNA
<213> Bordetella pertussis

<400> 91
gtgtccatga tcgcacgtat ttccctgcgg cctctgaagg ggctcgcggt ggctgtcctg 60
gcagcctccg ccctgaccgc ctgctcgtcc ggcaaatggg gattccccta caaggccggc 120
gtccagcaag gcaactggat caccaaagag caggtcgccc tgctgcagca aggcatgtcg 180
cgcgaacagg tgcgcttcgc cctgggcagc cccacgctga ccagcgtgct gcacgccgat 240
cgctgggatt acccctacta cttcaagccc ggctacggca aggcgcagga acgccagttc 300

accgtgtggt tcgagaacga ccacctggta cgctggagcg gggatgaaca gcccgacctc 360
cagccgttcc agatcgagaa agtgaacgcc aaacaggaag aaaaagccga cgcccaggtg 420
gatacggccg agaagcgcca ggaaggcatc gacaaggctg aaaaagtccg gccccatgtc 480
gatgtcacga cgccggacaa ccccaccctc gactacccgg gcgagccggg ccaaaccttc 540
gaaccgctca agtaa 555

<210> 92
<211> 184
<212> PRT
<213> Bordetella pertussis

<400> 92
Val Ser Met Ile Ala Arg Ile Ser Leu Arg Pro Leu Lys Gly Leu Ala
1 5 10 15
Val Ala Val Leu Ala Ala Ser Ala Leu Thr Ala Cys Ser Ser Gly Lys
20 25 30
Trp Gly Phe Pro Tyr Lys Ala Gly Val Gln Gln Gly Asn Trp Ile Thr
35 40 45
Lys Glu Gln Val Ala Leu Leu Gln Gln Gly Met Ser Arg Glu Gln Val
50 55 60
Arg Phe Ala Leu Gly Ser Pro Thr Leu Thr Ser Val Leu His Ala Asp
65 70 75 80
Arg Trp Asp Tyr Pro Tyr Tyr Phe Lys Pro Gly Tyr Gly Lys Ala Gln
85 90 95
Glu Arg Gln Phe Thr Val Trp Phe Glu Asn Asp His Leu Val Arg Trp
100 105 110
Ser Gly Asp Glu Gln Pro Asp Leu Gln Pro Phe Gln Ile Glu Lys Val
115 120 125
Asn Ala Lys Gln Glu Glu Lys Ala Asp Ala Gln Val Asp Thr Ala Glu
130 135 140
Lys Arg Gln Glu Gly Ile Asp Lys Ala Glu Lys Val Arg Pro His Val
145 150 155 160
Asp Val Thr Thr Pro Asp Asn Pro Thr Leu Asp Tyr Pro Gly Glu Pro
165 170 175
Gly Gln Thr Phe Glu Pro Leu Lys
180

<210> 93
<211> 549
<212> DNA
<213> Bordetella pertussis

<400> 93
atggcgaccc atcctgtcgg gccaacgttg ctggcggcgc tgacgctgct tgccgcctgc 60
agcggttcca tggcgcaaga gccgccctac aagagcacga tactgggctt gcaggcgacc 120
atcctggacc tgaagggctt gccgtccgac accgacggcg gcatatcgga cctgagcgcc 180
caagtgggtg cgctggccgc gcgccatgaa ggcgtgtcgg tacggcaggg caaggatgcc 240
gtcaccatcg ccatgatggg cgacgtactc ttcgatttcg acaaggccga catactcgcc 300
gcggccgaac ccactctgcg ggacatcgcg gagctgatca aatcccccgc caccggcatc 360
gtcgccattg aaggtcacac ggactccaag ggctcggatt cctataacaa gggcctgtca 420
ttgcgacggg cccaggccgt tgcgcagtgg ctgggcgctc acggggtgga tgcagcgaaa 480
ctgtcggtca ggggcctggg ggctgccagg cccgtacagc ccaaccagct agctgtgaag 540
attcaatag 549

<210> 94
<211> 182
<212> PRT
<213> Bordetella pertussis

<400> 94

```
Met Ala Thr His Pro Val Gly Pro Thr Leu Leu Ala Ala Leu Thr Leu
 1               5                  10                  15
Leu Ala Ala Cys Ser Gly Ser Met Ala Gln Glu Pro Pro Tyr Lys Ser
            20                  25                  30
Thr Ile Leu Gly Leu Gln Ala Thr Ile Leu Asp Leu Lys Gly Leu Pro
        35                  40                  45
Ser Asp Thr Asp Gly Gly Ile Ser Asp Leu Ser Ala Gln Val Gly Ala
    50                  55                  60
Leu Ala Ala Arg His Glu Gly Val Ser Val Arg Gln Gly Lys Asp Ala
65                  70                  75                  80
Val Thr Ile Ala Met Met Gly Asp Val Leu Phe Asp Phe Asp Lys Ala
                85                  90                  95
Asp Ile Leu Ala Ala Ala Glu Pro Thr Leu Arg Asp Ile Ala Glu Leu
            100                 105                 110
Ile Lys Ser Pro Ala Thr Gly Ile Val Ala Ile Glu Gly His Thr Asp
        115                 120                 125
Ser Lys Gly Ser Asp Ser Tyr Asn Lys Gly Leu Ser Leu Arg Arg Ala
    130                 135                 140

Gln Ala Val Ala Gln Trp Leu Gly Ala His Gly Val Asp Ala Ala Lys
145                 150                 155                 160
Leu Ser Val Arg Gly Leu Gly Ala Ala Arg Pro Val Gln Pro Asn Gln
                165                 170                 175
Leu Ala Val Lys Ile Gln
            180
```

<210> 95
<211> 504
<212> DNA
<213> Bordetella pertussis

<400> 95
```
atgaactata tgcattcccc ctctgtagtt gccgggcgcg cccgccgcct gctggcggta 60
gcggcggttg ccggctcggt ggccgttctg gccggctgcg ccaatcccag cgcatcgagt 120
ggggtgtaca cgtacggcca ggcgcagcgc gagcagatcg tgcgcaccgg cacggtcacc 180
ggcgtgcgtc cgattaccat ccagaacgac aagtccagcg gcgtcggctt ggtggccggt 240
ggcgcgctgg gcggggtagc gggcaatgcc gtcggcggcg gcaccggccg caccatcgcc 300
acggtgggcg gcgtcatcct cggcgcgctg gcgggcaacg ccatcgagaa ccgcgcgggc 360
aagtcctccg gctacgaaat cacggtgcgc ctggacaacg gcgaaacccg ggtcgtggcg 420
caggaagccg acgtgcccat cagcgtgggc cagcgcgtgc aggtcatcag cggcgcgggc 480
ccgacccgcg tgacaccgta ttga                                       504
```

<210> 96
<211> 167
<212> PRT
<213> Bordetella pertussis

<400> 96
```
Met Asn Tyr Met His Ser Pro Ser Val Val Ala Gly Arg Ala Arg Arg
 1               5                  10                  15
Leu Leu Ala Val Ala Ala Val Ala Gly Ser Val Ala Val Leu Ala Gly
            20                  25                  30
Cys Ala Asn Pro Ser Ala Ser Ser Gly Val Tyr Thr Tyr Gly Gln Ala
        35                  40                  45
Gln Arg Glu Gln Ile Val Arg Thr Gly Thr Val Thr Gly Val Arg Pro
    50                  55                  60
Ile Thr Ile Gln Asn Asp Lys Ser Ser Gly Val Gly Leu Val Ala Gly
65                  70                  75                  80
Gly Ala Leu Gly Gly Val Ala Gly Asn Ala Val Gly Gly Gly Thr Gly
                85                  90                  95
```

```
Arg Thr Ile Ala Thr Val Gly Gly Val Ile Leu Gly Ala Leu Ala Gly
            100                 105                 110
Asn Ala Ile Glu Asn Arg Ala Gly Lys Ser Ser Gly Tyr Glu Ile Thr
        115                 120                 125
Val Arg Leu Asp Asn Gly Glu Thr Arg Val Val Ala Gln Glu Ala Asp
    130                 135                 140
Val Pro Ile Ser Val Gly Gln Arg Val Gln Val Ile Ser Gly Ala Gly
145                 150                 155                 160
Pro Thr Arg Val Thr Pro Tyr
                165
```

<210> 97
<211> 459
<212> DNA
<213> Bordetella pertussis

<400> 97
ttggcgttga tcagcaaaaa ggagcgcatc ttgaaaaccc tgctacccgt attggcgctt 60
gccgccctgc tgtcggcctg caacgcgaac gccccctcgg atacgcccga gggcgcgccg 120
ccgcccgata cgcatacctc gcgcaattcg ctggactggc aaggcacgta ccagggcgtg 180
ctgccgtgcg ccgactgccc cggcatccgc acggtgctga ccctgcgcgc cgacaacacc 240
taccagttgc agacccagta cctggagcgc cagccccgcc cggacacggt gcaaggcaga 300
ttcggctggc tgacgggcga caacgccatc gagctcgaca gcgccggcga tcactaccgt 360
taccaggtcg gcgaaaaccg gctgaccatg atgtcgcaag acggcaccct gcccagcggc 420
ccgttggccg agcactacgt gctcaagcgc agccagtga 459

<210> 98
<211> 152
<212> PRT
<213> Bordetella pertussis

<400> 98
```
Leu Ala Leu Ile Ser Lys Lys Glu Arg Ile Leu Lys Thr Leu Leu Pro
 1               5                  10                  15
Val Leu Ala Leu Ala Ala Leu Leu Ser Ala Cys Asn Ala Asn Ala Pro
            20                  25                  30
Ser Asp Thr Pro Glu Gly Ala Pro Pro Pro Asp Thr His Thr Ser Arg
        35                  40                  45
Asn Ser Leu Asp Trp Gln Gly Thr Tyr Gln Gly Val Leu Pro Cys Ala
    50                  55                  60
Asp Cys Pro Gly Ile Arg Thr Val Leu Thr Leu Arg Ala Asp Asn Thr
65                  70                  75                  80
Tyr Gln Leu Gln Thr Gln Tyr Leu Glu Arg Gln Pro Arg Pro Asp Thr
                85                  90                  95
Val Gln Gly Arg Phe Gly Trp Leu Thr Gly Asp Asn Ala Ile Glu Leu
            100                 105                 110
Asp Ser Ala Gly Asp His Tyr Arg Tyr Gln Val Gly Glu Asn Arg Leu
        115                 120                 125
Thr Met Met Ser Gln Asp Gly Thr Leu Pro Ser Gly Pro Leu Ala Glu
    130                 135                 140
His Tyr Val Leu Lys Arg Ser Gln
145                 150
```

<210> 99
<211> 5310
<212> DNA
<213> Bordetella pertussis

<400> 99

atgagacggt taaaggccca ggctttcgaa ggcagccgca gcaggccggc aggacatggg 60
gtggcgccta ccttgctggc gctggccctg gggttccagg gggcggcggc gtgggccaat 120
tgcaccacct cggggtccaa caccacttgc accgcagccg gcggagcgca tcgcgccaag 180
gtaggggggcg gctctaccgg gaacaaccaa cacgtcacgg tgcaggccgg tgcgcggatc 240
gaggccggcg acagcggggc catcagcgtg ggcaataaca gccgagtcca gatccaggac 300

ggcgccgtcg tgcaaagcac ggtcaatact gctgcgtccg gccagtacgc caaaacgctg 360
gaagcagcaa gcaataacaa tatttccatc caagtaggcg cgcagctcct ggccaagggc 420
agcgcttcgc agtccagcgc gttgggattg tcaggcgccg gcaataccgt caccaaccat 480
ggcacgatcc gggccgataa tgccgcggca atctggatca ctgccaatac cgccaatgcg 540
gccaatacca tcgataacta cgggactatc gaaacagtgc tcaatggcgg ctacgccaac 600
gccatcggca gcacgcggaa caacagcgcc acgggcgctg gcgtgacggt acgcaatcat 660
gccaacgggc gcatcgtcgg caacgtgaag ttcgaggctg gcgacgacag cgtcatactc 720
gacggcggct ctaccatcac cggatccttg aacggtggca gcggcaacaa cagcctgacg 780
ctgaaagccg gcgacggcac gctgggccgc gcaatccgca acttcggcac gatcaccaag 840
caggaggctg gaacctggac cctgaatggc caggtcggcc gcaacgacaa caacttcaag 900
tccacggtca aggtggaggg cggcacgctg gtcttgcgcg gcgataacag cggcgccacc 960
cagggcggcg tgttgcaggt gtccgccggc gctacggcgg acgtaactgc cgccagcgcc 1020
atgcagtcca tcagcaacgc cggcacggtt cagttcacgc aggacagcaa tgccgcctac 1080
gccggcgtgc tgagcgggac cgggagcatc gtcaagcgcg gcggcggcga cctgacgttg 1140
acgggcaaca acacccatac cggcaaggtg gtggtggagg cgggcagcct cagcgtatcg 1200
gcggccaaca acctgggtgg cgcaggtagt tcggtacagc tcaagggcgg cgccctcgcc 1260
ctcaagaaaa ccatcgccgt caatcgcggc ctgacgctcg attccggggc gcagacgttg 1320
atcatcgagc cgggaacaac cacgacctgg caaggccagg tcagtggcgc cggcaaactg 1380
gtgacccagg gcggcacgct ggtgctggag cacgcgtcca atacgtatag cggcggtacg 1440
gagatcaaca acggaacgct gcgggcggcg catgacgcca gcctgggttc cggcacgttg 1500
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aatcagcaaa atggcggcac gaccgtcaat gccggtacgc tgcagatatc ccgcgacgcc 1740
aatcttggcc gaggggcgct ggcgctgaac gacggcacgc tgcagagcac cggcagcttc 1800
gcgacctcgc gcgcggccac cttgcgcggc caggccacca tggaggtcga cgcttcgcat 1860
accgtgacct ggaatggcga gctgagcggc ggcggcatgt tgcgcaagtc aggccagggc 1920
acgctggccc tggccggcgc caacacgtac tcgggtggca cggtggtcga ggccggcgcg 1980
cttcgggcag gacacgaaga caacctggga cggggcgcaa taaccctgca gggcggagat 2040
ctgcttgccg gcggcagttt ttcgagcaac cgcgatctca cgcttgtccg cggttccttg 2100
gacgtggctc gcgacgctac cctgacctgg aacggtgcga tatcgggcgc cggcgatctg 2160
gtcaaaacgg gggacgggac cctggcgctc actggcgtca acgagtacgc cggccagacc 2220
gtgctcaggc aaggcaagct gcgcgtggcc agggaagaaa gcctgggcgg cgctgcgctg 2280
gtgctggaaa acaatacggt gttcgagagt gcgggctcgt atgccatcgg gcggcgagtc 2340
acgctcaagg gcgcgcccaa ggtggcaacg cccgcgggcg acacgctcga atggcgcggc 2400
acggtcgacg gcgacggcaa gctgtacaag caaggcggcg gcacgctcgt gctgagcggc 2460
aacaatacct acgccaaggg cgtcgaggtc tggggcgggg tcgtgcaagt ctctcgcgac 2520
cagaacctgg gcgcggccaa tggcgcggtc acgctcaacg gcggcgggtt ggcggccaac 2580
ggggatttca ccagcaatcg ccagctggag ctgaccgccg gggccaaggc catcgacgtc 2640
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gccggcgacg gcaccttgag gttggagagc gtcaacacct acaccggtgg cacgcgcttg 2760
cagggcggca ccgtgcaggt atcgcgcgac aacaacctag gccaggccgc cggcgcggtc 2820
acgttcgacg gcgggcggct ggccagcacc ggcagctttg cgaccgcacg cgcggccacg 2880
ctcaacaacg ccggccagat cgataccgcc cagggcacca cgctgacgtg gaacggcgcc 2940
attggcggca agggcgagct gcgcaagcaa ggggcgggca ccctggtgct gggcggcgcc 3000
aacacttacc agggcgacac ccgcgtcgag gctggcacgc tgcaggtgtc ggccgacgcc 3060
aatctgggcc agggcgccgt gcatctgcac gacagccggc tggcgacgac cggtaccttc 3120
gcgacctcgc gccgtctgga gttgaccgga cgtggcacgg tgcaagcggc tgccgccgcc 3180
acgctggatt ggcgcgggac ggtggctggc gccggcacgc tggtcaagga aggcgcaggc 3240
acgctggtgc tggccggcga caaccagcat gccggcggca ccctggtcca cggcggcacg 3300
ctgcgcatcg cccgcgacgc caacctgggc gcggcgggca cggcggtgac gctggacggc 3360
ggcacgctgg ccaccacggc atcgttggcg ctggatcgcg cgctgcgcgt cggggcgcgc 3420
aatggcgtat tgctgccgga cgcgggcacg accctggatt ggcggggcgt ggtcgccggc 3480
gcgggcaagc tgaccaaggc cggtccgggc atgctggtgc tcagcgccga caaccgccat 3540
ggcggcggca cggcagtcac cggcggtacg ctgcaagtct cgcgcgacgc caacctgggc 3600

gcggcggccg gcgccctgac gctggacggc ggcactttgc tgagcaccgc cagctttgcc 3660
tcggcgcgtg ccgccaccct cgatgccgcg ggcggcacct tcgtcacccg cgacggcacc 3720
cggctggatt gggacggcgc gataggcggg gcgggtggcc tggtcaagga gggcgccggc 3780
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ctggccgtca acggcagcat cgccagcccg gtcacggtcg agcaggctgg cgtgctgggc 3900
ggcacgggcc gcatcgtcgg ggatgtggcc aaccgcggcg tggtcgcgcc gggcaactcg 3960
atcggcgcgt tgacggtagc cggcaattac gctggtaccg gcggcagcct ggaagtggag 4020
gcggtgcttg gcggcgacgc cgcgccggcc gatcggctgg tgcttgacgg cggcgcggcc 4080
agcggtgtca cgccggtcgt ggtcaagccg cagggcgggg tgggcggcct gaccctgcgc 4140
ggcattccgg tggtcgtggc ccagggtggc gccacgaccg cgcccggggc cttccgcctg 4200
gcgcagccgc tggtcgcggg cgcctacgag taccagttgc tgcgcggcgc gggcgacggc 4260
gccgcggcgc aggcgcagga ctggtacctg cgtacgtccc gcgtcgagcg cgacaaggcg 4320
ggcaggatcg tcaaggtcgt gcccttctac cggcccgagg tggcgctgta tgccggcacg 4380
ccgatgctga tgcgcatgac aggcacggaa atgctgggca gctatcgcga gcgggcgggc 4440
cagactggtg cggtgtcgcc cgaagcgggc gccacggccg cgcgcggtgg atgggcgcgc 4500
accttcggcc gccgtttcga gcgttccgcc ggcggcgagg ccgcgccgtc cttcgacggc 4560
catttggccg gcgcgcaact gggcgcggac ctctacgcgc gcagctcggg cacgcggcat 4620
accgacgcct tcggggtgtt cggcggatat gccacggtgc gcggcgacgt gcatggcctg 4680
gcgcgtggcg aaatccaggc cgtggggacg tccacgctgc gggccaccca attgggcgcc 4740
tattggaccc acactggtcc gggcggctgg tacatcgaca cggtgctggc cggcacgcgc 4800
tacaggcagc agacgaagtc gtccgctcag gtcggcgctg tcagccgcgg ctgggggatg 4860
acggcttcgg tggaggcggg ctatccgtgg cagctcaacc cgcgctggcg catcgaaccg 4920
caggcccagg tggtgtatca gcaactgggc attgccaatg gcgccgaccg cgtgtccacg 4980
gtgtcgtaca agacgcccga tgcgctgacg gctcggttag gtacgcgcct gtcgggccag 5040
tacgcatacg ggaaggcgca gttgcggccg ttcatgggcg tatcgctgct gcacgatttc 5100
accggcgcgg acaccgtcac gttcgcgggc gcgcatggcg tacgcgccag ccgccagaac 5160
acggccgtgg atctgaaggc gggcgtggac acgcagctgg gcaagagcgt aggcctgtgg 5220
gggcaggtag gctacggcaa gtcggtcggc agcggcgacg gcagcgaccg tggctggagc 5280
gccaacctgg ggctgcgcgt ggcgtattga 5310

<210> 100
<211> 1769
<212> PRT
<213> Bordetella pertussis

<400> 100
Met Arg Arg Leu Lys Ala Gln Ala Phe Glu Gly Ser Arg Ser Arg Pro
 1   5   10   15
Ala Gly His Gly Val Ala Pro Thr Leu Leu Ala Leu Ala Leu Gly Phe
            20   25   30
Gln Gly Ala Ala Ala Trp Ala Asn Cys Thr Thr Ser Gly Ser Asn Thr
        35   40   45
Thr Cys Thr Ala Ala Gly Gly Ala His Arg Ala Lys Val Gly Gly Gly
    50   55   60
Ser Thr Gly Asn Asn Gln His Val Thr Val Gln Ala Gly Ala Arg Ile
65   70   75   80
Glu Ala Gly Asp Ser Gly Ala Ile Ser Val Gly Asn Asn Ser Arg Val
                85   90   95
Gln Ile Gln Asp Gly Ala Val Val Gln Ser Thr Val Asn Thr Ala Ala
            100   105   110
Ser Gly Gln Tyr Ala Lys Thr Leu Glu Ala Ala Ser Asn Asn Asn Ile
        115   120   125
Ser Ile Gln Val Gly Ala Gln Leu Leu Ala Lys Gly Ser Ala Ser Gln
    130   135   140
Ser Ser Ala Leu Gly Leu Ser Gly Ala Gly Asn Thr Val Thr Asn His
145   150   155   160
Gly Thr Ile Arg Ala Asp Asn Ala Ala Ala Ile Trp Ile Thr Ala Asn
                165   170   175
Thr Ala Asn Ala Ala Asn Thr Ile Asp Asn Tyr Gly Thr Ile Glu Thr

```
            180                 185                 190
Val Leu Asn Gly Gly Tyr Ala Asn Ala Ile Gly Ser Thr Arg Asn Asn
        195                 200                 205
Ser Ala Thr Gly Ala Gly Val Thr Val Arg Asn His Ala Asn Gly Arg
    210                 215                 220
Ile Val Gly Asn Val Lys Phe Glu Ala Gly Asp Asp Ser Val Ile Leu
225                 230                 235                 240
Asp Gly Gly Ser Thr Ile Thr Gly Ser Leu Asn Gly Gly Ser Gly Asn
                245                 250                 255
Asn Ser Leu Thr Leu Lys Ala Gly Asp Gly Thr Leu Gly Arg Ala Ile
            260                 265                 270
Arg Asn Phe Gly Thr Ile Thr Lys Gln Glu Ala Gly Thr Trp Thr Leu
        275                 280                 285
Asn Gly Gln Val Gly Arg Asn Asp Asn Asn Phe Lys Ser Thr Val Lys
    290                 295                 300
Val Glu Gly Gly Thr Leu Val Leu Arg Gly Asp Asn Ser Gly Ala Thr
305                 310                 315                 320
Gln Gly Gly Val Leu Gln Val Ser Ala Gly Ala Thr Ala Asp Val Thr
                325                 330                 335
Ala Ala Ser Ala Met Gln Ser Ile Ser Asn Ala Gly Thr Val Gln Phe
            340                 345                 350
Thr Gln Asp Ser Asn Ala Ala Tyr Ala Gly Val Leu Ser Gly Thr Gly
        355                 360                 365
Ser Ile Val Lys Arg Gly Gly Gly Asp Leu Thr Leu Thr Gly Asn Asn
    370                 375                 380
Thr His Thr Gly Lys Val Val Val Glu Ala Gly Ser Leu Ser Val Ser
385                 390                 395                 400
Ala Ala Asn Asn Leu Gly Gly Ala Gly Ser Ser Val Gln Leu Lys Gly
                405                 410                 415
Gly Ala Leu Ala Leu Lys Lys Thr Ile Ala Val Asn Arg Gly Leu Thr
            420                 425                 430
Leu Asp Ser Gly Ala Gln Thr Leu Ile Ile Glu Pro Gly Thr Thr Thr
        435                 440                 445
Thr Trp Gln Gly Gln Val Ser Gly Ala Gly Lys Leu Val Thr Gln Gly
    450                 455                 460
Gly Thr Leu Val Leu Glu His Ala Ser Asn Thr Tyr Ser Gly Gly Thr
465                 470                 475                 480
Glu Ile Asn Asn Gly Thr Leu Arg Ala Ala His Asp Ala Ser Leu Gly
                485                 490                 495
Ser Gly Thr Leu Ala Leu Lys Asn Ser Gln Leu Ala Ala Thr Asp Ser
            500                 505                 510
Phe Thr Ala Thr Arg Ala Leu Thr Leu Ala Gly Asn Glu Ser Ile Asp
        515                 520                 525
Val Ala Ala Thr Lys Ile Leu Ser Trp Asn Gly Glu Ile Ser Gly Ala
    530                 535                 540
Gly Thr Leu Val Lys Glu Gly Gln Gly Thr Leu Leu Leu Arg Gly Thr
545                 550                 555                 560
Asn Gln Gln Asn Gly Gly Thr Thr Val Asn Ala Gly Thr Leu Gln Ile
                565                 570                 575
Ser Arg Asp Ala Asn Leu Gly Arg Gly Ala Leu Ala Leu Asn Asp Gly
            580                 585                 590
Thr Leu Gln Ser Thr Gly Ser Phe Ala Thr Ser Arg Ala Ala Thr Leu
        595                 600                 605
Arg Gly Gln Ala Thr Met Glu Val Asp Ala Ser His Thr Val Thr Trp
    610                 615                 620
Asn Gly Glu Leu Ser Gly Gly Gly Met Leu Arg Lys Ser Gly Gln Gly
625                 630                 635                 640
Thr Leu Ala Leu Ala Gly Ala Asn Thr Tyr Ser Gly Gly Thr Val Val
                645                 650                 655
Glu Ala Gly Ala Leu Arg Ala Gly His Glu Asp Asn Leu Gly Arg Gly
            660                 665                 670
```

Ala Ile Thr Leu Gln Gly Gly Asp Leu Leu Ala Gly Gly Ser Phe Ser
675 680 685
Ser Asn Arg Asp Leu Thr Leu Val Arg Gly Ser Leu Asp Val Ala Arg
690 695 700
Asp Ala Thr Leu Thr Trp Asn Gly Ala Ile Ser Gly Ala Gly Asp Leu
705 710 715 720
Val Lys Thr Gly Asp Gly Thr Leu Ala Leu Thr Gly Val Asn Glu Tyr
725 730 735
Ala Gly Gln Thr Val Leu Arg Gln Gly Lys Leu Arg Val Ala Arg Glu
740 745 750
Glu Ser Leu Gly Gly Ala Ala Leu Val Leu Glu Asn Asn Thr Val Phe
755 760 765
Glu Ser Ala Gly Ser Tyr Ala Ile Gly Arg Arg Val Thr Leu Lys Gly
770 775 780
Ala Pro Lys Val Ala Thr Pro Ala Gly Asp Thr Leu Glu Trp Arg Gly
785 790 795 800
Thr Val Asp Gly Asp Gly Lys Leu Tyr Lys Gln Gly Gly Gly Thr Leu
805 810 815
Val Leu Ser Gly Asn Asn Thr Tyr Ala Lys Gly Val Glu Val Trp Gly
820 825 830
Gly Val Val Gln Val Ser Arg Asp Gln Asn Leu Gly Ala Ala Asn Gly
835 840 845
Ala Val Thr Leu Asn Gly Gly Gly Leu Ala Ala Asn Gly Asp Phe Thr
850 855 860
Ser Asn Arg Gln Leu Glu Leu Thr Ala Gly Ala Lys Ala Ile Asp Val
865 870 875 880
Ala Ala Gly Lys Asp Val Thr Trp Arg Gly Val Val Asn Gly Ala Gly
885 890 895
Ala Leu Thr Lys Ala Gly Asp Gly Thr Leu Arg Leu Glu Ser Val Asn
900 905 910
Thr Tyr Thr Gly Gly Thr Arg Leu Gln Gly Gly Thr Val Gln Val Ser
915 920 925
Arg Asp Asn Asn Leu Gly Gln Ala Ala Gly Ala Val Thr Phe Asp Gly
930 935 940
Gly Arg Leu Ala Ser Thr Gly Ser Phe Ala Thr Ala Arg Ala Ala Thr
945 950 955 960
Leu Asn Asn Ala Gly Gln Ile Asp Thr Ala Gln Gly Thr Thr Leu Thr
965 970 975
Trp Asn Gly Ala Ile Gly Gly Lys Gly Glu Leu Arg Lys Gln Gly Ala
980 985 990
Gly Thr Leu Val Leu Gly Gly Ala Asn Thr Tyr Gln Gly Asp Thr Arg
995 1000 1005
Val Glu Ala Gly Thr Leu Gln Val Ser Ala Asp Ala Asn Leu Gly Gln
1010 1015 1020
Gly Ala Val His Leu His Asp Ser Arg Leu Ala Thr Thr Gly Thr Phe
1025 1030 1035 1040
Ala Thr Ser Arg Arg Leu Glu Leu Thr Gly Arg Gly Thr Val Gln Ala
1045 1050 1055
Ala Ala Ala Ala Thr Leu Asp Trp Arg Gly Thr Val Ala Gly Ala Gly
1060 1065 1070
Thr Leu Val Lys Glu Gly Ala Gly Thr Leu Val Leu Ala Gly Asp Asn
1075 1080 1085
Gln His Ala Gly Gly Thr Leu Val His Gly Gly Thr Leu Arg Ile Ala
1090 1095 1100
Arg Asp Ala Asn Leu Gly Ala Ala Gly Thr Ala Val Thr Leu Asp Gly
1105 1110 1115 1120
Gly Thr Leu Ala Thr Thr Ala Ser Leu Ala Leu Asp Arg Ala Leu Arg
1125 1130 1135
Val Gly Ala Arg Asn Gly Val Leu Leu Pro Asp Ala Gly Thr Thr Leu
1140 1145 1150
Asp Trp Arg Gly Val Val Ala Gly Ala Gly Lys Leu Thr Lys Ala Gly

```
       1155                1160                1165
Pro Gly Met Leu Val Leu Ser Ala Asp Asn Arg His Gly Gly Gly Thr
    1170                1175                1180
Ala Val Thr Gly Gly Thr Leu Gln Val Ser Arg Asp Ala Asn Leu Gly
1185                1190                1195                1200
Ala Ala Ala Gly Ala Leu Thr Leu Asp Gly Gly Thr Leu Leu Ser Thr
                1205                1210                1215
Ala Ser Phe Ala Ser Ala Arg Ala Ala Thr Leu Asp Ala Ala Gly Gly
            1220                1225                1230
Thr Phe Val Thr Arg Asp Gly Thr Arg Leu Asp Trp Asp Gly Ala Ile
        1235                1240                1245
Gly Gly Ala Gly Gly Leu Val Lys Glu Gly Ala Gly Glu Leu Arg Leu
    1250                1255                1260
Gly Asn Ala Asn Thr Tyr Gln Gly Pro Thr Arg Ile Ala Ala Gly Arg
1265                1270                1275                1280
Leu Ala Val Asn Gly Ser Ile Ala Ser Pro Val Thr Val Glu Gln Ala
                1285                1290                1295
Gly Val Leu Gly Gly Thr Gly Arg Ile Val Gly Asp Val Ala Asn Arg
            1300                1305                1310
Gly Val Val Ala Pro Gly Asn Ser Ile Gly Ala Leu Thr Val Ala Gly
        1315                1320                1325
Asn Tyr Ala Gly Thr Gly Gly Ser Leu Glu Val Glu Ala Val Leu Gly
    1330                1335                1340
Gly Asp Ala Ala Pro Ala Asp Arg Leu Val Leu Asp Gly Gly Ala Ala
1345                1350                1355                1360
Ser Gly Val Thr Pro Val Val Val Lys Pro Gln Gly Gly Val Gly Gly
                1365                1370                1375
Leu Thr Leu Arg Gly Ile Pro Val Val Val Ala Gln Gly Gly Ala Thr
            1380                1385                1390
Thr Ala Pro Gly Ala Phe Arg Leu Ala Gln Pro Leu Val Ala Gly Ala
        1395                1400                1405
Tyr Glu Tyr Gln Leu Leu Arg Gly Ala Gly Asp Gly Ala Ala Ala Gln
    1410                1415                1420
Ala Gln Asp Trp Tyr Leu Arg Thr Ser Arg Val Glu Arg Asp Lys Ala
1425                1430                1435                1440
Gly Arg Ile Val Lys Val Val Pro Phe Tyr Arg Pro Glu Val Ala Leu
                1445                1450                1455
Tyr Ala Gly Thr Pro Met Leu Met Arg Met Thr Gly Thr Glu Met Leu
            1460                1465                1470
Gly Ser Tyr Arg Glu Arg Ala Gly Gln Thr Gly Ala Val Ser Pro Glu
        1475                1480                1485
Ala Gly Ala Thr Ala Ala Arg Gly Gly Trp Ala Arg Thr Phe Gly Arg
    1490                1495                1500
Arg Phe Glu Arg Ser Ala Gly Gly Glu Ala Ala Pro Ser Phe Asp Gly
1505                1510                1515                1520
His Leu Ala Gly Ala Gln Leu Gly Ala Asp Leu Tyr Ala Arg Ser Ser
                1525                1530                1535
Gly Thr Arg His Thr Asp Ala Phe Gly Val Phe Gly Gly Tyr Ala Thr
            1540                1545                1550
Val Arg Gly Asp Val His Gly Leu Ala Arg Gly Glu Ile Gln Ala Val
        1555                1560                1565
Gly Thr Ser Thr Leu Arg Ala Thr Gln Leu Gly Ala Tyr Trp Thr His
    1570                1575                1580
Thr Gly Pro Gly Gly Trp Tyr Ile Asp Thr Val Leu Ala Gly Thr Arg
1585                1590                1595                1600
Tyr Arg Gln Gln Thr Lys Ser Ser Ala Gln Val Gly Ala Val Ser Arg
                1605                1610                1615
Gly Trp Gly Met Thr Ala Ser Val Glu Ala Gly Tyr Pro Trp Gln Leu
            1620                1625                1630
Asn Pro Arg Trp Arg Ile Glu Pro Gln Ala Gln Val Val Tyr Gln Gln
        1635                1640                1645
```

```
Leu Gly Ile Ala Asn Gly Ala Asp Arg Val Ser Thr Val Ser Tyr Lys
    1650                1655                1660
Thr Pro Asp Ala Leu Thr Ala Arg Leu Gly Thr Arg Leu Ser Gly Gln
1665                1670                1675                1680
Tyr Ala Tyr Gly Lys Ala Gln Leu Arg Pro Phe Met Gly Val Ser Leu
                1685                1690                1695
Leu His Asp Phe Thr Gly Ala Asp Thr Val Thr Phe Ala Gly Ala His
            1700                1705                1710
Gly Val Arg Ala Ser Arg Gln Asn Thr Ala Val Asp Leu Lys Ala Gly
        1715                1720                1725
Val Asp Thr Gln Leu Gly Lys Ser Val Gly Leu Trp Gly Gln Val Gly
    1730                1735                1740
Tyr Gly Lys Ser Val Gly Ser Gly Asp Gly Ser Asp Arg Gly Trp Ser
1745                1750                1755                1760
Ala Asn Leu Gly Leu Arg Val Ala Tyr
                1765
```

<210> 101
<211> 582
<212> DNA
<213> Bordetella pertussis

<400> 101
```
atgaacaaac cctccaaatt cgctctggcg ctcgccttcg ccgctgttac ggcctctggt 60
gcagcttccg cgcaaaccgt ggacaactgg cgcaatccgt ttggcgacgt ttggaagaac 120
ggcaccaatg aactgtgctg gcgcgatgcg ttctggaccc cggctaccgg catccccggt 180
tgcgacggcg ttccggtcgc tcagaaggaa aagtccgctc ccatggccgc caaggtcgtg 240
ttcaatgctg acaccttctt cgacttcgac aagtcgacgc tgaagccgga aggccgccag 300
ctgctggatc aagtcgccca gcaagccggc acgatcgatc tggaaacgat catcgccgtt 360
ggccacacgg actcgatcgg caccgaagcc tacaaccaga agctgtccga gcgccgtgcc 420
gctgcggtca agacctacct ggtcagcaag ggtatcgacc ccaaccgtat ctacacggaa 480
ggcaagggcg aactgcaacc gatcgcttcg aacaagacgc gtgaaggccg tgcccagaac 540
cgtcgcgtgg aaatcgaaat cgtcggtagc cgcaagaact aa                    582
```

<210> 102
<211> 193
<212> PRT
<213> Bordetella pertussis

<400> 102
```
Met Asn Lys Pro Ser Lys Phe Ala Leu Ala Leu Ala Phe Ala Ala Val
 1               5                  10                  15
Thr Ala Ser Gly Ala Ala Ser Ala Gln Thr Val Asp Asn Trp Arg Asn
            20                  25                  30
Pro Phe Gly Asp Val Trp Lys Asn Gly Thr Asn Glu Leu Cys Trp Arg
        35                  40                  45
Asp Ala Phe Trp Thr Pro Ala Thr Gly Ile Pro Gly Cys Asp Gly Val
    50                  55                  60
Pro Val Ala Gln Lys Glu Lys Ser Ala Pro Met Ala Ala Lys Val Val
65                  70                  75                  80
Phe Asn Ala Asp Thr Phe Phe Asp Phe Asp Lys Ser Thr Leu Lys Pro
                85                  90                  95
Glu Gly Arg Gln Leu Leu Asp Gln Val Ala Gln Gln Ala Gly Thr Ile
            100                 105                 110
Asp Leu Glu Thr Ile Ile Ala Val Gly His Thr Asp Ser Ile Gly Thr
        115                 120                 125
Glu Ala Tyr Asn Gln Lys Leu Ser Glu Arg Arg Ala Ala Ala Val Lys
    130                 135                 140
Thr Tyr Leu Val Ser Lys Gly Ile Asp Pro Asn Arg Ile Tyr Thr Glu
145                 150                 155                 160
```

```
Gly Lys Gly Glu Leu Gln Pro Ile Ala Ser Asn Lys Thr Arg Glu Gly
                165                 170                 175
Arg Ala Gln Asn Arg Arg Val Glu Ile Glu Ile Val Gly Ser Arg Lys
            180                 185                 190
Asn
```

<210> 103
<211> 582
<212> DNA
<213> Bordetella pertussis

<400> 103
atgaacaaac cctccaaatt cgctctggcg ctcgccttcg ccgctgttac ggcctctggt 60
gcagcttccg cgcaaaccgt ggacaactgg cgcaatccgt ttggcgacgt ttggaagaac 120
ggcaccaatg aactgtgctg gcgcgatgcg ttctggaccc cggctaccgg catccccggt 180
tgcgacggcg ttccggtcgc tcagaaggaa aagcccgctc ccatggccgc caaggtcgtg 240
ttcaatgctg acaccttctt cgacttcgac aagtcgacgc tgaagccgga aggccgccag 300
ctgctggatc aagtcgccca gcaagccggc acgatcgatc tggaaacgat catcgccgtt 360
ggccacacgg actcgatcgg caccgaagcc tacaaccaga agctgtccga gcgccgtgcc 420
gctgcggtca agacctacct ggtcagcaag ggtatcgacc ccaaccgtat ctacacggaa 480
ggcaagggcg aactgcaacc gatcgcttcg aacaagacgc gtgaaggccg tgcccagaac 540
cgtcgcgtgg aaatcgagat cgtcggtagc cgcaagaact aa   582

<210> 104
<211> 193
<212> PRT
<213> Bordetella pertussis

<400> 104
```
Met Asn Lys Pro Ser Lys Phe Ala Leu Ala Leu Ala Phe Ala Ala Val
 1               5                  10                  15
Thr Ala Ser Gly Ala Ala Ser Ala Gln Thr Val Asp Asn Trp Arg Asn
            20                  25                  30
Pro Phe Gly Asp Val Trp Lys Asn Gly Thr Asn Glu Leu Cys Trp Arg
        35                  40                  45
Asp Ala Phe Trp Thr Pro Ala Thr Gly Ile Pro Gly Cys Asp Gly Val
    50                  55                  60
Pro Val Ala Gln Lys Glu Lys Pro Ala Pro Met Ala Ala Lys Val Val
65                  70                  75                  80
Phe Asn Ala Asp Thr Phe Phe Asp Phe Asp Lys Ser Thr Leu Lys Pro
                85                  90                  95
Glu Gly Arg Gln Leu Leu Asp Gln Val Ala Gln Gln Ala Gly Thr Ile
            100                 105                 110
Asp Leu Glu Thr Ile Ile Ala Val Gly His Thr Asp Ser Ile Gly Thr
        115                 120                 125
Glu Ala Tyr Asn Gln Lys Leu Ser Glu Arg Arg Ala Ala Ala Val Lys
    130                 135                 140
Thr Tyr Leu Val Ser Lys Gly Ile Asp Pro Asn Arg Ile Tyr Thr Glu
145                 150                 155                 160
Gly Lys Gly Glu Leu Gln Pro Ile Ala Ser Asn Lys Thr Arg Glu Gly
                165                 170                 175
Arg Ala Gln Asn Arg Arg Val Glu Ile Glu Ile Val Gly Ser Arg Lys
            180                 185                 190
Asn
```

<210> 105
<211> 2232

<212> DNA
<213> Bordetella pertussis

<400> 105
atgaagttct acccttccca tccgatgccc gagtcgctcg cggctgcgat cgcagtgcct 60
ctgttgggcc tgctgccggc ggcgcaggcc gcgtccacgg cggtccagct gccatccgtc 120
acggtcgagg gcgagtactc gtcctatcaa ccggaaagcg cccagtcgcc caagttcacc 180
gcgcccctgg cggacacgcc gcgcacggtg caggtcatcc ctgagcggct catccaggac 240
caggggcca gcgacctcga agcggtactg cgcaatgcgc cagggatatc gatgaccgcc 300
ggcgaaggcg gccgtccggc cagcgacctg ccgttcatcc gcggccagaa ttcggccagc 360
agcctgtttg tcgacggcct gcgcgatccc agcacgcaat cgcgcgatac cttcaacctg 420
gaacaggtcg acgtcgtcaa ggggcccgat tcggtatttt ccgggcgcgg cggcgccggc 480
ggaagcatca acctcgtcac caagacgccc aggaaccagg atttcaccga agtccaggcc 540
ggcatcggga cggccgagac ctaccgaggc accatagacg gcaactgggt gctgggcgag 600
aacacggcgc tgcgcctcaa cctgctgggc accaggggca ccgtgccggg ccgcgacaag 660
gcggtcgagt tcagccgcgt gggtatcgcg ccatcgctgc gcctgggcct gagcggcccc 720
acccgcgtga cgctgggcct gtacctctat cgccaccggc gggttcccga ttattcgatt 780
ccgtacgatc cgcgcaccgg cacgccgatc accgagacca tcggggtcag ccgccgcaac 840
ttctacggcc tggtgcagcg cgactccggc gataccgagg actacgccgc caccgtcaaa 900
tgggagcacg acctcgccaa tggcttcaag gtggagaacc tggcgcgcta ctcgcgcgcc 960
acggtggagc agatcaccac catccccgaa ctgaaaaccg ccgatctggc caaagggctg 1020
gtgtaccgca atctgcgcgc cagctaccag gtcaacgaca gtttcgccaa ccgcaccgac 1080
ctgcgcggca cattcgacac ggggcagtgg cgccatacct tcgatctggg cggggagttc 1140
gccaccagcc ggcgcagtcg cgaccgctac aagcaggaaa tccccgacgc cgccagtcct 1200
tgctcgcccg tgacgggcgg caacaatccc gccctgtgcg cctcgctccg ggatccggat 1260
ccgcacgtgg atttcccggg aacggtgcgg cgcaaccata acccggcccg ctaccacacc 1320
gacatcctgt ccctgtacgg tttcgacacc atcgccttcg acgagcagtg gcagctgaat 1380
ctcggcctgc gctgggacca ctacaagacc agcggacgca acctgccggt acgaggcgcc 1440
aagccgcccg tctacgagag cgccgcgcgt accgacaacc tgttcaacta ccagctcggc 1500
ctggtctaca agcctcgtcc ggacggctcg gtgtatgcga gctacggcac ggcgtccacg 1560
ccgtcggccg tgtccgacta cgccccggcg gacaacatct ccggcacaag ccagcagttc 1620
aagccggagc gcagcgaggt gatcgaggtc gggaccaagt ggcaggtgct ggaccggcgg 1680
ctgctggtga cgggcgccat gttccgcgaa acgcgcaaga acaccagcat cgaagtcgcc 1740
gaaggcctgc gcgcaccggc cggcaagagc cgcgtcaccg gcatggagct gggcgtggcg 1800
ggcagcctga cgccgcgctg ggacgtctac ggcggctacg cgctgctcga cagcaagctg 1860
gtcagggcca gccataacag cggggcgcaa ggccagccgc tgcccagcgc gccccggcac 1920
gcattcagca tctggagcac ctacaagctg ctgccggagc tgaccgtggg ggccggcgcg 1980
ttctatcgca gcaaggtcta tggcaacgca gatgccggcc acaacaagga cggcacgccc 2040
aaggcgcgct gggtgccggc gtactggcgc ttcgacgcca tggcggcgta ccagctcaac 2100
aagcacctta cggcccagtt gaacgtctac aacctgctcg acaagaccta ttacgccaag 2160
acctaccgca gccattacgc ggcgctgggt ccggggcggt ccgccatgct gacgttcaag 2220
ctgagctact ga 2232

<210> 106
<211> 743
<212> PRT
<213> Bordetella pertussis

<400> 106
Met Lys Phe Tyr Pro Ser His Pro Met Pro Glu Ser Leu Ala Ala Ala
 1   5   10   15
Ile Ala Val Pro Leu Leu Gly Leu Leu Pro Ala Ala Gln Ala Ala Ser
            20   25   30
Thr Ala Val Gln Leu Pro Ser Val Thr Val Glu Gly Glu Tyr Ser Ser
        35   40   45
Tyr Gln Pro Glu Ser Ala Gln Ser Pro Lys Phe Thr Ala Pro Leu Ala
    50   55   60
Asp Thr Pro Arg Thr Val Gln Val Ile Pro Glu Arg Leu Ile Gln Asp
65   70   75   80
Gln Gly Ala Ser Asp Leu Glu Ala Val Leu Arg Asn Ala Pro Gly Ile
                85   90   95

```
Ser Met Thr Ala Gly Glu Gly Gly Arg Pro Ala Ser Asp Leu Pro Phe
            100                 105                 110
Ile Arg Gly Gln Asn Ser Ala Ser Ser Leu Phe Val Asp Gly Leu Arg
        115                 120                 125
Asp Pro Ser Thr Gln Ser Arg Asp Thr Phe Asn Leu Glu Gln Val Asp
    130                 135                 140
Val Val Lys Gly Pro Asp Ser Val Phe Ser Gly Arg Gly Gly Ala Gly
145                 150                 155                 160
Gly Ser Ile Asn Leu Val Thr Lys Thr Pro Arg Asn Gln Asp Phe Thr
                165                 170                 175
Glu Val Gln Ala Gly Ile Gly Thr Ala Glu Thr Tyr Arg Gly Thr Ile
            180                 185                 190
Asp Gly Asn Trp Val Leu Gly Glu Asn Thr Ala Leu Arg Leu Asn Leu
        195                 200                 205
Leu Gly Thr Arg Gly Thr Val Pro Gly Arg Asp Lys Ala Val Glu Phe
    210                 215                 220
Ser Arg Val Gly Ile Ala Pro Ser Leu Arg Leu Gly Leu Ser Gly Pro
225                 230                 235                 240
Thr Arg Val Thr Leu Gly Leu Tyr Leu Tyr Arg His Arg Arg Val Pro
                245                 250                 255
Asp Tyr Ser Ile Pro Tyr Asp Pro Arg Thr Gly Thr Pro Ile Thr Glu
            260                 265                 270
Thr Ile Gly Val Ser Arg Arg Asn Phe Tyr Gly Leu Val Gln Arg Asp
        275                 280                 285
Ser Gly Asp Thr Glu Asp Tyr Ala Ala Thr Val Lys Trp Glu His Asp
    290                 295                 300
Leu Ala Asn Gly Phe Lys Val Glu Asn Leu Ala Arg Tyr Ser Arg Ala
305                 310                 315                 320
Thr Val Glu Gln Ile Thr Thr Ile Pro Glu Leu Lys Thr Ala Asp Leu
                325                 330                 335
Ala Lys Gly Leu Val Tyr Arg Asn Leu Arg Ala Ser Tyr Gln Val Asn
            340                 345                 350
Asp Ser Phe Ala Asn Arg Thr Asp Leu Arg Gly Thr Phe Asp Thr Gly
        355                 360                 365
Gln Trp Arg His Thr Phe Asp Leu Gly Gly Glu Phe Ala Thr Ser Arg
    370                 375                 380
Arg Ser Arg Asp Arg Tyr Lys Gln Glu Ile Pro Asp Ala Ala Ser Pro
385                 390                 395                 400
Cys Ser Pro Val Thr Gly Gly Asn Asn Pro Ala Leu Cys Ala Ser Leu
                405                 410                 415
Arg Asp Pro Asp Pro His Val Asp Phe Pro Gly Thr Val Arg Arg Asn
            420                 425                 430
His Asn Pro Ala Arg Tyr His Thr Asp Ile Leu Ser Leu Tyr Gly Phe
        435                 440                 445
Asp Thr Ile Ala Phe Asp Glu Gln Trp Gln Leu Asn Leu Gly Leu Arg
    450                 455                 460
Trp Asp His Tyr Lys Thr Ser Gly Arg Asn Leu Pro Val Arg Gly Ala
465                 470                 475                 480
Lys Pro Pro Val Tyr Glu Ser Ala Ala Arg Thr Asp Asn Leu Phe Asn
                485                 490                 495
Tyr Gln Leu Gly Leu Val Tyr Lys Pro Arg Pro Asp Gly Ser Val Tyr
            500                 505                 510
Ala Ser Tyr Gly Thr Ala Ser Thr Pro Ser Ala Val Ser Asp Tyr Ala
        515                 520                 525
Pro Ala Asp Asn Ile Ser Gly Thr Ser Gln Gln Phe Lys Pro Glu Arg
    530                 535                 540
Ser Glu Val Ile Glu Val Gly Thr Lys Trp Gln Val Leu Asp Arg Arg
545                 550                 555                 560
Leu Leu Val Thr Gly Ala Met Phe Arg Glu Thr Arg Lys Asn Thr Ser
                565                 570                 575
Ile Glu Val Ala Glu Gly Leu Arg Ala Pro Ala Gly Lys Ser Arg Val
```

```
            580                 585                 590
Thr Gly Met Glu Leu Gly Val Ala Gly Ser Leu Thr Pro Arg Trp Asp
        595                 600                 605
Val Tyr Gly Gly Tyr Ala Leu Leu Asp Ser Lys Leu Val Arg Ala Ser
    610                 615                 620
His Asn Ser Gly Ala Gln Gly Gln Pro Leu Pro Ser Ala Pro Arg His
625                 630                 635                 640
Ala Phe Ser Ile Trp Ser Thr Tyr Lys Leu Leu Pro Glu Leu Thr Val
                645                 650                 655
Gly Ala Gly Ala Phe Tyr Arg Ser Lys Val Tyr Gly Asn Ala Asp Ala
            660                 665                 670
Gly His Asn Lys Asp Gly Thr Pro Lys Ala Arg Trp Val Pro Ala Tyr
        675                 680                 685
Trp Arg Phe Asp Ala Met Ala Ala Tyr Gln Leu Asn Lys His Leu Thr
    690                 695                 700
Ala Gln Leu Asn Val Tyr Asn Leu Leu Asp Lys Thr Tyr Tyr Ala Lys
705                 710                 715                 720
Thr Tyr Arg Ser His Tyr Ala Ala Leu Gly Pro Gly Arg Ser Ala Met
                725                 730                 735
Leu Thr Phe Lys Leu Ser Tyr
            740
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<210> 107
<211> 1158
<212> DNA
<213> Bordetella pertussis

<400> 107
atgaaaaaga ctctgctcgc tgccgccctg ctcgccggtt tcgccggtgc cgctcaggca 60
gaaacgtcgg tcaccctgta cggtatcatc gacacgggta tcggctacaa cgatgtcgat 120
ttcaaggtga aaggcgctaa cgccgacgac agcgacttca agtacaacca cagccgcttc 180
ggcatgatca acggcgtgca gaacggttcg cgctggggtc tgcgtggtac ggaagatctg 240
ggtgacggcc tgcaagctgt gttccaactg gaatcgggct tcaactcggg caacggtaac 300
tcggcccaag acggccgcct gttcggtcgc caagccacca tcggtctgca aagcgaaagc 360
tggggccgtc tggacttcgg tcgccaaacc aacatcgcct cgaagtactt cggctcgatc 420
gatccgttcg gcgctggctt cggtcaagcc aacatcggca tgggcatgag cgcgatgaac 480
accgttcgct acgacaacat ggtcatgtac cagaccccgt cgtacagcgg cttccagttc 540
ggtatcggct actcgttcag cgcgaacgac aaggatgctg acgccgtcaa ccgcgttggc 600
ttcgccaccg ccgacaacgt tcgtgccatc acgaccggtc tgcgctacgt gaacggcccg 660
ctgaacgtcg ctctgtcgta cgaccagctg aacgcctcga acaaccaagc ccaaggcgaa 720
gttgacgcga ccccgcgcag ctacggcctc ggcggttcgt atgacttcga agtcgtgaag 780
ctggctctgg cctacgctcg cacgaccgac ggctggttcg gtggccaagg ctacccggtc 840
gccgtcacgc tgccctcggg cgacaagttc ggcggcttcg gcgtgaacac cttcgctgac 900
ggcttcaagg ccaactcgta catggtcggc ctgtcggccc ccatcggcgg cgccagcaac 960
gtgttcggtt cgtggcagat ggttgacccc aagctgaccg gcggcgacga gaagatgaac 1020
gtcttctcgc tgggctacac ctacgacctg tccaagcgca ccaacctgta cgcctacggt 1080
tcgtacgcca agaacttcgc gttcctggaa gatgccaagt cgaccgctgt cggcgtcggt 1140
atccgtcacc gcttctaa 1158

<210> 108
<211> 385
<212> PRT
<213> Bordetella pertussis

<400> 108
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Met Lys Lys Thr Leu Leu Ala Ala Ala Leu Leu Ala Gly Phe Ala Gly
 1               5                  10                  15
Ala Ala Gln Ala Glu Thr Ser Val Thr Leu Tyr Gly Ile Ile Asp Thr
            20                  25                  30
Gly Ile Gly Tyr Asn Asp Val Asp Phe Lys Val Lys Gly Ala Asn Ala
```

```
        35                  40                  45
Asp Asp Ser Asp Phe Lys Tyr Asn His Ser Arg Phe Gly Met Ile Asn
    50                  55                  60
Gly Val Gln Asn Gly Ser Arg Trp Gly Leu Arg Gly Thr Glu Asp Leu
65                  70                  75                  80
Gly Asp Gly Leu Gln Ala Val Phe Gln Leu Glu Ser Gly Phe Asn Ser
                85                  90                  95
Gly Asn Gly Asn Ser Ala Gln Asp Gly Arg Leu Phe Gly Arg Gln Ala
            100                 105                 110
Thr Ile Gly Leu Gln Ser Glu Ser Trp Gly Arg Leu Asp Phe Gly Arg
        115                 120                 125
Gln Thr Asn Ile Ala Ser Lys Tyr Phe Gly Ser Ile Asp Pro Phe Gly
    130                 135                 140
Ala Gly Phe Gly Gln Ala Asn Ile Gly Met Gly Met Ser Ala Met Asn
145                 150                 155                 160
Thr Val Arg Tyr Asp Asn Met Val Met Tyr Gln Thr Pro Ser Tyr Ser
                165                 170                 175
Gly Phe Gln Phe Gly Ile Gly Tyr Ser Phe Ser Ala Asn Asp Lys Asp
            180                 185                 190
Ala Asp Ala Val Asn Arg Val Gly Phe Ala Thr Ala Asp Asn Val Arg
        195                 200                 205
Ala Ile Thr Thr Gly Leu Arg Tyr Val Asn Gly Pro Leu Asn Val Ala
    210                 215                 220
Leu Ser Tyr Asp Gln Leu Asn Ala Ser Asn Asn Gln Ala Gln Gly Glu
225                 230                 235                 240
Val Asp Ala Thr Pro Arg Ser Tyr Gly Leu Gly Gly Ser Tyr Asp Phe
                245                 250                 255
Glu Val Val Lys Leu Ala Leu Ala Tyr Ala Arg Thr Thr Asp Gly Trp
            260                 265                 270
Phe Gly Gly Gln Gly Tyr Pro Val Ala Val Thr Leu Pro Ser Gly Asp
        275                 280                 285
Lys Phe Gly Gly Phe Gly Val Asn Thr Phe Ala Asp Gly Phe Lys Ala
    290                 295                 300
Asn Ser Tyr Met Val Gly Leu Ser Ala Pro Ile Gly Gly Ala Ser Asn
305                 310                 315                 320
Val Phe Gly Ser Trp Gln Met Val Asp Pro Lys Leu Thr Gly Gly Asp
                325                 330                 335
Glu Lys Met Asn Val Phe Ser Leu Gly Tyr Thr Tyr Asp Leu Ser Lys
            340                 345                 350

Arg Thr Asn Leu Tyr Ala Tyr Gly Ser Tyr Ala Lys Asn Phe Ala Phe
        355                 360                 365
Leu Glu Asp Ala Lys Ser Thr Ala Val Gly Val Gly Ile Arg His Arg
    370                 375                 380
Phe
385
```

<210> 109
<211> 1167
<212> DNA
<213> Bordetella pertussis

<400> 109
atgaaaaaga ctctgctcgc tgccgccctg ctcgccggtt tcgccggtgc cgctcaggca 60
gaaacgtcgg tcaccctgta cggtatcatc gacacgggta tcggctacaa cgatgtcgat 120
ttcaaggtga aaggcgctaa cgccgacggc agcgacttca agtacaacca cagccgcttc 180
ggcatgatca acggcgtgca gaacggttcg cgctggggtc tgcgtggtac ggaagatctg 240
ggtgacggcc tgcaagctgt gttccaactg gaatcgggct tcagctcggc caacggtaac 300
tcggcccaag acggtcgcct gttcggtcgt caagccacca tcggtctgca aagcgaaagc 360
tggggccgtc tggacttcgg tcgccaaacc aacatcgcct cgaagtactt cggctcgatc 420

```
gatccgttcg gcgctggctt cggtcaagcc aacatcggca tgggcatgag cgcgatgaac 480
accgttcgct acgacaacat ggtcatgtac cagaccccgt cgtacagcgg cttccagttc 540
ggtatcggct actcgttcag cgcgaacgac aaggacgctg acgccgtcaa ccgcgttggc 600
ttcgccaccg ccgacaacgt tcgtgccatc acgaccggtc tgcgctacgt gaacggcccg 660
ctgaacgtcg ctctgtcgta cgaccagctg aacgcctcga acaaccaagc ccaagacgaa 720
gttgacgcca ccccgcgcag ctacggcatc ggcggttcgt atgacttcga agtcgtgaag 780
ctggctctgg cctacgctcg cacgaccgac ggctggttcg gtggccaagg ctacccggtc 840
gctgtcacgc tgccctcggg cgacaagttc ggcggcttcg gcgtgaacac cttcgctgac 900
ggcttcaagg ccaactccta cctgttgggc ctgtcggctc cgatcggcgg cgccagcaac 960
gtgttcggtt cgtggcagat ggttgacccc agcaacgaca agctgaccgg cggcgacgag 1020
aagatgaacg tcttctcgct gggctacacc tacgacctgt ccaagcgcac caacctgtac 1080
gcctacggtt cgtacgccaa gaacttcgcg ttcctggaag atgccaagtc gaccgctgtc 1140
ggcgtcggta tccgtcaccg cttctaa                                      1167
```

<210> 110
<211> 388
<212> PRT
<213> Bordetella pertussis

<400> 110

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Met Lys Lys Thr Leu Leu Ala Ala Ala Leu Leu Ala Gly Phe Ala Gly
 1               5                  10                  15
Ala Ala Gln Ala Glu Thr Ser Val Thr Leu Tyr Gly Ile Ile Asp Thr
            20                  25                  30
Gly Ile Gly Tyr Asn Asp Val Asp Phe Lys Val Lys Gly Ala Asn Ala
        35                  40                  45
Asp Gly Ser Asp Phe Lys Tyr Asn His Ser Arg Phe Gly Met Ile Asn
    50                  55                  60
Gly Val Gln Asn Gly Ser Arg Trp Gly Leu Arg Gly Thr Glu Asp Leu
65                  70                  75                  80
Gly Asp Gly Leu Gln Ala Val Phe Gln Leu Glu Ser Gly Phe Ser Ser
                85                  90                  95
Ala Asn Gly Asn Ser Ala Gln Asp Gly Arg Leu Phe Gly Arg Gln Ala
            100                 105                 110
Thr Ile Gly Leu Gln Ser Glu Ser Trp Gly Arg Leu Asp Phe Gly Arg
        115                 120                 125
Gln Thr Asn Ile Ala Ser Lys Tyr Phe Gly Ser Ile Asp Pro Phe Gly
    130                 135                 140
Ala Gly Phe Gly Gln Ala Asn Ile Gly Met Gly Met Ser Ala Met Asn
145                 150                 155                 160
Thr Val Arg Tyr Asp Asn Met Val Met Tyr Gln Thr Pro Ser Tyr Ser
                165                 170                 175
Gly Phe Gln Phe Gly Ile Gly Tyr Ser Phe Ser Ala Asn Asp Lys Asp
            180                 185                 190
Ala Asp Ala Val Asn Arg Val Gly Phe Ala Thr Ala Asp Asn Val Arg
        195                 200                 205
Ala Ile Thr Thr Gly Leu Arg Tyr Val Asn Gly Pro Leu Asn Val Ala
    210                 215                 220
Leu Ser Tyr Asp Gln Leu Asn Ala Ser Asn Asn Gln Ala Gln Asp Glu
225                 230                 235                 240
Val Asp Ala Thr Pro Arg Ser Tyr Gly Ile Gly Gly Ser Tyr Asp Phe
                245                 250                 255
Glu Val Val Lys Leu Ala Leu Ala Tyr Ala Arg Thr Thr Asp Gly Trp
            260                 265                 270
Phe Gly Gly Gln Gly Tyr Pro Val Ala Val Thr Leu Pro Ser Gly Asp
        275                 280                 285
Lys Phe Gly Gly Phe Gly Val Asn Thr Phe Ala Asp Gly Phe Lys Ala
    290                 295                 300
Asn Ser Tyr Leu Leu Gly Leu Ser Ala Pro Ile Gly Gly Ala Ser Asn
305                 310                 315                 320
Val Phe Gly Ser Trp Gln Met Val Asp Pro Ser Asn Asp Lys Leu Thr
```

```
                325                 330                 335
Gly Gly Asp Glu Lys Met Asn Val Phe Ser Leu Gly Tyr Thr Tyr Asp
            340                 345                 350
Leu Ser Lys Arg Thr Asn Leu Tyr Ala Tyr Gly Ser Tyr Ala Lys Asn
        355                 360                 365

Phe Ala Phe Leu Glu Asp Ala Lys Ser Thr Ala Val Gly Val Gly Ile
    370                 375                 380
Arg His Arg Phe
385
```